Managing Victoria's bushfire risk

Fuel management report 2017-18

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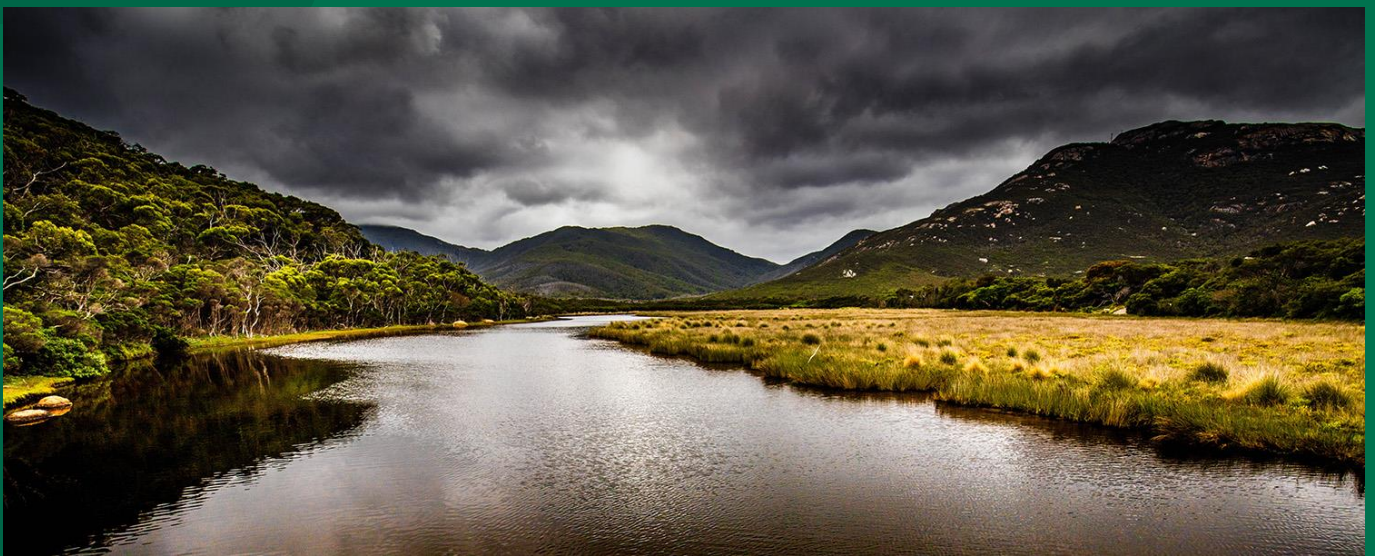
The department pays its respect and proudly acknowledges the contribution and continued commitment to land and resource management by Victoria's Traditional Owners, their rich culture and the intrinsic connection they have to Country.

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Front cover image: Salahuddin Ahmad

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What's happening near me?

Darrin McKenzie, Chief Fire Officer, March to September 2018

'Support' is a word Darrin McKenzie, FFMVic's Deputy Chief Fire Officer, uses a lot when he talks about his colleagues on the fuel management frontline around the state of Victoria. 'Planned burning is our highest-risk activity', says Darrin. 'We need a heap of risk management when we go around lighting fires. I want our people to know that at the top we're keenly interested in what they do, support them to do it and appreciate them for it. I want Victorians to know that, too.'

Prioritising to reduce risk

In 2017–18, Darrin has overseen our fuel management response to what's called around the state as 'the Big Dry'. The soil and fuels are as dry as in the early-to-mid 2000s, when we had large, remote forest fires. 'We're not as bad as in 2009 after 10 years of drought, but we're certainly getting to early-to-mid-2000s levels, when forest fires burned several million hectares over two or three years', says Darrin.

The key to reducing bushfire risk is to target high-priority areas around the state. 'We used a prioritisation tool this year that worked out the 71 sites ready for burning where we could see the greatest reduction in statewide and local risk' says Darrin. 'So, if the conditions are right — and planned burning opportunities only come around for some sites once every 10 years or so — those are the sites we really have to do', says Darrin. 'For example, wetter forest types can only be burned in a particularly dry year, like last year. So we did planned burns in the Wombat Forest and along the Great Ocean Road at the back Lorne and Anglesea', says Darrin. 'It was really pleasing to get those done.'

But that can also mean reallocating resources and abandoning another planned burn. 'That can be the hardest call of all' says Darrin. 'There can be a lot of pressure to do a burn, to get a program done, with the crew all there ready to go. Sometimes the toughest decision to make is the one not to go ahead with a burn.'

Risk is up, but a good outcome considering the circumstances

'This year the bushfire risk went up by a few percent statewide, to 66%', says Darrin. 'It's up in some regions, and steady in others. But burning in high-priority areas like the Otway Ranges, the Wombat Forest and the Dandenongs kept it down in those areas and restrained the increase across the state.' Despite this, Darrin is satisfied with what's been achieved. 'There are years where we have three months or more for planned burning. This year, we had to do the bulk of it in a two-and-a-half-week window in mid-April through to early May. That's very narrow for us, and we deploy all our resources to get as much possible in such a short period', he says. 'We're also concerned that climate change is going to continue to compress our planned burning opportunities into fairly narrow windows.'

'Our Reducing Bushfire Risk program receives significant funding from the government and allows us to implement a range of bushfire risk mitigation programs including treating hazardous trees, and improving access and egress to forests', says Darrin. 'In some years like this one, when we can't have a big planned burning program, our programs to slash and mulch are particularly important, and we must be set up to quickly switch resources to them and away from planned burning.'

Burning for ecology

Equally pleasing was the ecosystem resilience planned burning. This included grassland burns on the basalt plains near Melton to promote the growth of some rare grassland plant species and restore habitat for the Legless Lizard. 'We also did coastal heath burning, which is particularly important for that vegetation, along the east coast and some in the far south-west', says Darrin.

Community first

Another shift Darrin considers benefits the wider community is toward fire prevention and preparedness. 'Fire services worldwide tend to invest heavily in fire suppression —more fire trucks, more firefighters, more aircraft' he says. 'We're complementing that approach with a greater investment in reducing risk, in preventing fires and in being prepared. Which is good.'

Stakeholder feedback about these changes is increasingly positive, Darrin says. 'We meet at a state level with peak bodies including winemakers and tourism businesses, and we give them information they can

disseminate to their members', says Darrin. 'In the regions, we have one-on-one relationships with individual operators. We work hard on those relationships, and we get good outcomes from them.'

Darrin understands the general public's concerns about air quality, particularly following events such as the 2016 thunderstorm asthma fatalities. 'It really raised community awareness about air quality issues generally, and community concern can be quick to spread with social media. Communities in high-risk areas have reason to understand planned burning, whereas people in urban areas may not, says Darrin. 'Smoke from planned burning was an even bigger issue this year because of the tight burning window, when we generated more smoke simply from necessity.'

'We've got a lot more messaging now through online channels and social media, and we've got some sophisticated models to forecast likely concentrations of smoke', Darrin says. 'We can provide more information than ever before to the community in advance of a smoke-type event, and we can tell them how long we think the event might last. We're trying to help people understand what we are doing and why, and what it means for them.'

Barwon South West

Andrew Morrow Assistant Chief Fire Officer

As regional fire chief, Andrew Morrow's Barwon South West patch is one of Victoria's premier holiday, tourism and wilderness destinations, known internationally for its iconic Great Ocean Road. 'It's a busy place', says Andrew. 'There are major tourism events along the coast pretty much every week during our team's burn program.' The team's work is essential to protect the assets and values that underpin the region's tourist economy. In 2017–18, the Great Ocean Road area alone attracted 5.4 million visitors, generating $1.3 billion and 11,200 jobs.

Dry, disjointed but risk kept down

This year, dry conditions ended Andrew's teams planned burning early. 'We had a mild summer and geared up to do some early planned burning. We got burns in around Lorne and Forrest, and down at Gorae and Nelson in the far south-west, but then it became too dry. We needed to stop until we got some more moisture in the landscape.'

It ended up being a more disjointed season than most. 'We had significant fires in the south-west on March 17, and we were burning from the middle-to-late-March period. We eventually got some more opportunities in May', he says. The dry conditions weren't all bad news, though. 'Because it was so dry, some planned burning at Lorne actually got better results than burning when it's wetter', Andrew says.

'The Otways contribute about 20% of the state's risk', Andrew says. Prioritising coastal towns like Lorne and Anglesea is essential – planned burns in those areas yield the biggest reductions in risk to life and property. But deeper into the Otway Ranges, the risk levels are just as important.

'In the Otways, we started 2017–18 at 61.5% bushfire risk and we had a target of 60%', says Andrew. 'With no planned burning, bushfire risk would have risen by 5%. Instead, we only had a 1% increase. That's higher than we want, but it's still manageable. We were effectively lacking one burn window. If we had had it, I think we would be close to the 60% mark.'

'In the far south-west, we mitigated 3% risk compared with doing no burning', says Andrew. 'Overall, we took the available opportunities and achieved an effective program.'

The region has important assets to protect. The plantations in far south-west Victoria and across the border into South Australia make up 20% of Australia's plantation timber industry and move lots of timber to the port of Portland.

'We've got essential power and gas assets like the SP AusNet Heywood power substation on the edge of the Mount Clay State Forest, that we reduce risk to with planned burning. And the team uses smoke modelling and schedule burns to minimise disruption to the grape harvest and to address any concerns about smoke taint.'

Community first

The team have formed strong partnerships with the Traditional Owners, particularly the Gunditjmara Aboriginal Cooperative in the far south-west of the region around the national-heritage-listed Budj Bim (formerly Mount Eccles) National Park.

'Our traditional burning program in and around the Budj Bim landscape — the Tyrendarra lava flow areas — is about the Gunditjmara people managing the land, about managing fuel and weeds. The program is building, and we strongly support it', Andrew says.

Working with the community means a lot to Andrew and the team. 'Many Lorne and Otways families have been here for generations, they're big admirers of our work,' he says. 'Stories of the 1939 Black Friday fires, 1983 Ash Wednesday fires and the 2015 Wye River Christmas fires get passed down through the generations, and they see fuel management as a good thing!'

'The Phoenix Rapidfire bushfire simulator also helps us explain risk and planned burning,' says Andrew.

He cites the October 2015 Wensleydale-Casboults Road fire, north of Aireys Inlet and Anglesea.

'The fire burnt up into an area we had previously planned burnt, which enabled us to control it and continue to control it during really strong winds a few days later. Without the planned burning, Phoenix modelling indicated we would have had a major fire threatening Aireys Inlet and Anglesea. That's really useful information to give to the locals.'

And there's lots of locals to keep in the loop, too.

'In the Otways, we email about 700 people and groups, working through community hubs — network points for us to get information out. We have a smaller number in the far south-west, but it's a similar process.'

Social media, particularly using video, also helps spread the message. A picture of a smoke column in a newspaper a few years ago had the locals worried.

'The photo made it look a bit like we were smothering the town', Andrew says, 'but now we're able to put up video of our aircraft at work and that helps people understand so much better.'

Working together

The Barwon South West team works closely with the CFA and local governments. 'We helped the CFA deploy their mobile education bus and property advisory service to Lorne and Forrest, with the theme of making Lorne a fire-ready community. It was a joint approach, and really successful', says Andrew.

Improving ecosystem resilience

While reducing risk to people is their highest priority, the team work hard to maintain and improve ecosystem resilience. In the far south-west, they target invasive woody weeds like pine wildings, pittosporum and coast wattle that spring up in the forests. 'We're actively mulching and dealing with coast wattle and pittosporum on burn sites in and around Gorae and Nelson, then following up with burning', Andrews says.

'We're restoring those sites back to a better mix and diversity of species.'

In particular, eliminating pine wilding weeds that spread from pine plantations into adjoining large areas of brown stringybark forest helps protect habitat for the much-loved south-eastern red-tailed black cockatoo.

Managing the impact of fire on wildlife is also important. While he and the team sadly acknowledge that some harm to animals and plants is unavoidable from planned burning, burning also helps plants and animals that need fire to stay healthy.

Better ways of working

Along the Great Ocean Road, Andrew and his team get planned burning help from above. In difficult areas, they get pinpoint accuracy and better control of ignition and lighting patterns with a helicopter using the aerial drip-torch method to ignite fires and aircraft to suppress them.

'Using the helicopter, we can control the rate and timing of the drip of fire and support the ground crews who are getting the edges of the fire all sorted out', Andrew says.

'Then the aircraft comes in and fills in the middle with nicely pinpointed ignition along ridge lines, so we get the burn depth and coverage we planned.'

'With all that activity in the air, it's important we tell people there's no reason to be alarmed, it's how we operate nowadays', says Andrew.

The same goes for smoke in the air. 'We can't do this business without making smoke, although we work to minimise the effects of smoke on communities. But we can always do more to make sure everyone understands how and when we need to go about planned burning.'

Gippsland

Chris Stephenson Assistant Chief Fire Officer

With more than 25 years' fire and forestry experience around the state, Chris Stephenson is happy to be back in Bairnsdale, a region he knows well. In those years, he's had a lot of bridge construction experience and he hasn't stopped building bridges – but these days, they're metaphorical. As a regional fire chief, he sees social engagement as essential to building trust.

Community first

'We get a lot of interest in Gippsland from remote communities and environmental groups', Chris says.

'Our research shows the majority supports what we do, but some people don't like planned burning and some people think we should do a lot more. There's a whole range of opinions here. There's no doubt planned burning has impacts, but that needs to be set against the impacts of major bushfires,' says Chris. 'Victoria's one of the most fire-prone places in the world, so we will have smoke in the atmosphere at some time. It's really about exercising as much control as we can to make it at the best and safest time.'

Traditional burning is also an expanding part of the team's program, through a close partnership with Gippsland's Traditional Owners.

'The Traditional Owners are heavily involved in planning: educating us about cultural values and helping us decide where to burn', Chris said. The team also partners with the CFA and Hancock Victorian Plantations. 'It's about protecting their resources and assets, as well as reducing risk across the board', says Chris.

A very, very dry season

In 2017–18, the biggest influence on planned burning in Gippsland were the very dry conditions. 'We had an extremely dry spring and one of our driest autumn periods for a long, long time, if not since records started', says Chris. 'The region is still incredibly dry.'

That meant few opportunities for planned burning. 'Over 90% of burning in Gippsland is in autumn', says Chris. 'Spring is not good for us. It's often too windy and our forest types don't suit broad-scale burning in spring. Having no window in autumn really cuts back our program.'

Gippsland has roughly 40% of the state's public land: vast amounts of forest requiring a vast amount of planned burning in a typical year, which wasn't possible this year.

Risk is below target

Gippsland's bushfire risk is sitting on target at 65%.

'We're below target but bushfire risk did increase a little. But it's not a matter of the metric this year, it's a matter of the weather', he says. 'It doesn't really matter target by risk or area, if you don't get the weather for planned burning, then there's no hope of a good news story.'

As well, the team was fighting bushfires when they would usually be doing planned burning. And fuel is starting to reaccumulate as the forests recover from the big bushfires of the last 15 years. 'We'll have to start reducing that fuel over the next few years', says Chris.

Another factor in Gippsland is the balance planned burning for two purposes: to reduce risk to communities, which is the priority, and to reduce the risk of 'campaign' bushfires that can cost the state many millions of

dollars to try to suppress. Campaign bushfires, for which Gippsland is notorious, typically burn in a very remote area and are hard to get at.

'We try our best to get our firefighters in, but these fires can grow a little bit day by day. Then we get some really bad days and they become half-million or million-hectare fires burning for many weeks. If a fire starts at Mount Hotham, it could potentially burn through to the coast — and burn everything in between', says Chris.

The Gippsland team regularly takes to the sky to learn from their large burns, especially in remote areas.

'We do a fair bit of work after our burning program to understand what we've achieved. We use a lot of aerial imagery, and we do a lot of post-burn fuel monitoring to make sure we've met our objectives.'

Improving ecosystem resilience

Gippsland's native plants and animals are important ecological assets. While their priority is protecting people and property, Chris and the team work with ecologists and other experts to better understand how fire affects the region's native species.

'We have to balance that too', says Chris. 'Aiming to manage an individual in a species, rather than a species as a collective, can have detrimental impacts.'

Ecological burns aim to promote the growth of specific species. 'We do ecological burns when it's most appropriate for particular species', he says. 'That's why we put those burns on our fire operations plan. Those burns reduce risk slightly for communities but mainly they're to keep that species healthy. We don't just burn to reduce the risk to life and property,' he says, 'we also burn to ensure our ecosystems survive and prosper. You've still got to have the right conditions, but we do small amounts of ecological burning throughout the year if there are opportunities.'

On the right track

With less planned burning to do, the team kept themselves busy improving infrastructure through the Reducing Bushfire Risk program.

'We improved roads, tracks to bridges and fire towers, to maintain access to rapidly suppress bushfires on public land. It's not just for our firefighters', Chris says. 'It's also to provide safe access and egress for communities and visitors in the forests and parks.'

The Gippsland team was also busy with non-fire fuel treatments. 'This year, we've reduced fuel by mechanical means, like mulching the understorey, rather than by planned burning around some communities', says Chris.

It's a reminder that even when fire activity is limited, the work is not. Whether they're mulching, monitoring, burning or bridge-building, Chris and the Gippsland team always have plenty to do.

Grampians

Peter Kambouris Assistant Chief Fire Officer (acting)

Peter Kambouris, Acting Assistant Chief Fire Officer for the Grampians region, admits it was a big change moving back to Ballarat after 20 years working in East Gippsland then living in Merimbula. 'You don't quite feel the sea breeze here in summer', he says.

Keeping bushfire risk down

As an ecologist with 25 years' forest, park and fire management experience, Peter is no stranger to seasonal and weather changes. And the Grampians region is a good example of how conditions can alter when it comes to fire risk.

Planned burning opportunities in the Wombat State Forest, north of Daylesford, are very limited because of the damp type of forest. Even if a burn is planned, the conditions are seldom right.

'We had no opportunities last year, so risk to some local communities increased', says Peter.

'But we had a great season this year, and we treated the highest-risk areas around the Wombat State Forest. In fact, the planned burn around Daylesford was probably the highest-risk-reduction burn in Victoria in autumn. But because we missed out last year, and to a lesser extent the year before, we haven't delivered the full, three-year fire operations plan.'

'As the population of towns like Daylesford and their surrounds keeps growing, there's lots more people and property than 20 years ago, which means there's lots more risk,' says Peter. 'Fuel loads accumulate, then either fire or our fuel management reduces them', he says.

Peter also emphasises the importance of protecting smaller communities and townships.

'A major bushfire in a remote community can wipe it out. We often assess risk in terms of loss of property, which can bias risk towards the larger towns and cities that are built-up. Whereas the risk of a community being entirely displaced or wiped out is an immense risk to that community.'

Doing nothing isn't an option, according to Peter. 'If we don't do planned burning, the risk will increase exponentially, and we won't be able to get ahead of the game and adequately reduce the risk again.'

Of Wombat State Forest, Peter says, 'Ash Wednesday was the last major fire event through the forest. All the planned burning in recent years, particularly the last decade, has reduced the risk to close to where it was immediately after Ash Wednesday', says Peter. 'That's a really important outcome for protecting the communities close to the forest.'

Looking further west toward the Grampians National Park, to the at-risk communities around Halls Gap, Pomonal and Dunkeld, Peter notes the significant fires of the last decade, including with planned burning, has significantly lowered risk for some time.

'But areas burnt by the first large fire there in 2006 are now coming back online as available fuel', says Peter. 'So we need to manage that intensively, to keep the threat to these communities low.'

Community first

While risk is a key factor in determining planned burning priorities, community and social needs are also on their radar.

'For me, our objective isn't only just reducing risk. We might also aim to protect an environmental value or avoid a social impact.'

Peter emphasises the need to communicate effectively with communities.

'We can't assume people understand the risk with living where they live, or that we do planned burning regularly to manage risk', Peter says.

'There's probably more opposition to what we do from people in high-density populations closer to Melbourne, who mightn't like seeing the natural vegetation they enjoy looking at being burnt, even though it's a planned burn under controlled conditions.

'People in more-remote communities are often descended from generations of people with bushfire experience. They have a very different, supportive outlook on the value of planned burning. So we work with local CFA brigades to engage with them. Delivery almost becomes the easy part once you've done all your engagement and your planning.'

Peter and the team have strong bonds with local winemakers.

'The grape-picking season coincides with the planned burn season – which is often restricted to a few weeks – so we keep them really well-informed about the conditions and our plans. And they keep us informed about what the state of their grapes, with different types of grapes coming on at different times', Peter says. 'This year, with the winemakers, we brought in Associate Professor Ian Porter from The Latrobe University. He researches smoke taint, which could potentially devastate grape crops.'

Relationships with the region's Traditional Owner groups are also strong the region. 'Several of our staff are from local, Traditional Owner communities', Peter says. In the last few years, Peter and the team have worked with the Wimmera's Barengi Gadjin Land Council and the Wotjobaluk people to bring traditional burning into their programs.

'We've done some traditional burning at Mount Arapiles-Tooan State Park in the Wimmera. As well as reducing risk, it celebrates the reintroduction of cultural practices to Country and the healing of Country. It's fantastic that we're able to support that.'

Improving ecosystem resilience

As an ecologist, Peter emphasises the ecological benefits of burning.

'In our larger landscapes away from densely populated areas, we've got a big ecological burning program. We're protecting habitat for some species, creating habitat for others or trying to reinstate natural, ecological processes through burning', he says.

Peter and the team were recently joined by specialist staff to help monitor a burned area in which the vulnerable brush-tailed phascogale had once been observed. After the burn, the team found evidence the little marsupials were still active in the area, and the team expect to see more of them in the next few years as the habitat becomes more suitable for them.

Hume

Aaron Kennedy Assistant Chief Fire Officer

Aaron Kennedy, Acting Assistant Chief Fire Officer for the Hume region, isn't the first Kennedy to make his name in north-east Victoria. That was a Sergeant Kennedy — no relation — who famously led a search for Ned Kelly at Stringybark Creek, not far from Aaron's base.

Community first

Aaron and the Hume team greatly value local knowledge. 'Historically, our planned burning program has tried hard to understand local communities, local risks and how local environmental conditions influence the movement of fires across the landscape' Aaron says.

'Knowing the landscape means knowing the locals. We try to prioritise areas where it's going to be hard to suppress a fire. To identify them, we need local knowledge about the area's fire history.'

Full-time community partnership support officers in each district work with staff and the community to identify people who will be most affected by each planned burn.

'We determine who we need to engage with and how and when we're going to engage. We have onsite meetings, make calls, do letterbox drops and use social media extensively.

There are 566 addresses on the region's email notification list, including 121 media outlets, and most stakeholders subscribe to the Planned Burning Notification System.

'An email goes out every day when we're burning', says Aaron.

'We've also very active posting material online and working through media outlets. During the peak planned burning period, from the start of March to the end of May, our Hume Facebook page reached almost 680,000 people, 35% more than the previous year, and it had 10% more followers. We posted 26 planned burning posts, including five videos that had almost 17,000 views.'

'We also meet with key industry groups —north-east vignerons, apiarists and tourism operators. Not actively engaging with key stakeholders is to our detriment. Grassroots communication, keeping everyone informed, is a constant part of the job', Aaron says.

The Hume region team works closely with interest groups, like the Strathbogie Community Bushfire Planning Group, which Aaron says 'is a great example of how FFMVic, local communities, the CFA, councils and other government agencies work together to identify priorities and minimise bushfire risks'.

The team also works closely with Traditional Owners to identify traditional burning opportunities in redgum forests and on grassland reserves. 'There's been traditional burning in the Barmah area for millennia', says Aaron.

'We've also done traditional burning in the Upper Murray. We're building stronger relationships with the Taungurong people and with Woka Walla, a Yorta Yorta Nation corporation, they're interested in traditional burning. These partnerships mean two-way sharing of knowledge about using fire to care for Country.'

Bushfire risk is below target

Reducing risk is a big part of Aaron's day-to-day responsibilities.

'We've had two difficult years for planned burning in a row, but three of our four fire districts remain below their bushfire risk targets. That's a great result, from targeting areas where could reduce risk the most.'

Aaron sees the challenge is to integrate additional factors into the risk landscape team's model.

'The model currently considers the impact of bushfire on life and property, but it doesn't fully consider the economic impacts of fire on things like agricultural production and timber plantations and our transport and power networks', says Aaron.

'VicForests is a big presence in the region and protecting that industry, given the decreasing access to hardwood plantations, is important. We also have transmission lines that run down to Melbourne through north-east Victoria.'

In recent years, there's been a shift in how planned burning and the resources to do it are prioritised.

'Before, we allocated resources according to district and regional priorities. Now we are seeing a concerted effort to look at the bigger picture and prioritise burns and resource allocation at the state level. That helps us particularly with asset-protection burns, which are usually much more resource-intensive than burns in more-remote country. Sometimes, we need to draw in resources from around the state to ensure we have adequate resources.'

'That also means we need to be able to explain to our local communities how burns are prioritised at a local, regional and state level' Aaron says.

'That's a challenge – being able to explain why one community's burn is more important than another's, getting the messaging about that right.'

Aaron feels being absolutely transparent with people is essential, although it can be hard conveying harsh realities, especially when plans change.

'I think we're very upfront and transparent. We don't hide the fact our work is determined by priorities. That's not always well received. For example, we may have a burn that's been prepared and ready for ignition for three, four, even five years, then we have to delay or cancel it because priorities change. Then we have to deal with the fallout not only from the community, who have expected the burn for so long, but also from our staff, who have put so much work into the planning. But that's the nature of planned burning. An area might only be available to burn one in every five years, so if weather and ground conditions are right, we need to immediately seize opportunities as they arise.'

Improving ecosystem resilience with science

Aaron and his team like to talk about their successful monitoring, evaluation and reporting programs for flora and fauna.

'The risk landscape team use geographic information systems to identify areas to burn, based on their fire history and the tolerable fire interval of the species', says Aaron.

Tolerable fire interval is an important concept: it's the length of time between one burn and the next that doesn't affect the species' ability to recover from fire.

'Our systems generate maps showing us areas which are available or not available for burning.'

To keep the maps up-to-date, after each planned burn or bushfire Aaron and the team also model the fire area and the intensity of the fire, and this data becomes part of the recorded fire history of the mapped area.

Loddon Mallee

Scott Falconer Assistant Chief Fire Officer

Having worked in fire, forestry, fisheries and wildlife for more than two decades around the state, Scott Falconer became the Loddon Mallee Assistant Chief Fire Officer in 2016. He's recently back from a Churchill Fellowship in the United States and Canada, where he saw how those countries manage bushfire risk and how well Victoria compares.

Community first

In the United States, Scott saw how fire management agencies are partnering with North American Indigenous people to do traditional burning on public lands.

This is useful learning, as Scott and the Loddon Mallee team are partnering with the Dja Dja Wurrung Clans Aboriginal Corporation in the Murray Goldfields district and with the Barapa Barapa group, Traditional Owners of the Gunbower forest on the River Murray, to increase traditional burning.

'We did seven traditional burns last year and two before that', says Scott.

'Overseas, we're seen as leading the world in respectfully enabling Traditional Owners to burn on Country. That's fire on public land, not on reservation: that's a different thing altogether and a lot of what happens in the Americas. Here, Traditional Owners select the areas for traditional burns and determine the purpose and objectives of the burns.'

In America, Scott also saw first-hand the consequences of letting planned burning programs lapse.

'The United States has largely lost the social licence for planned burning. That's something we absolutely must maintain', says Scott.

'California, for instance, has similar, large, destructive fires, but they've let planned burning lapse. They've got a huge amount of work to do to bring it back on a scale that will appreciably reduce risk. Maintaining the social licence for planned burning is crucial. As long as we can hold onto it, we're doing well.'

Listening to the Mallee

Scott and the team put great effort into explaining to the Loddon Mallee community how, why and when they do planned burning, particularly in the Mallee.

'We've invested heavily in a new engagement model, the Mallee Fire Advisory Committee, that has members of the public advising us about fire management. It's a great example of how we can protect and strengthen the social licence. And it gives us flexibility to take the more risk-based approach and burn less area than we did under the hectare target: about half, actually', says Scott.

The district has a relatively low risk to life and property because it has large tracts of public lands and not a lot of people, but it has a lot of environmental assets.

'Some species, particularly bird species, are at high risk of collapse. We work closely with BirdLife Australia who have a representative on the committee to address their concerns. Like everyone, we don't want to see species become extinct, especially because we all have natural resource management backgrounds.'

'We do a lot of work with environmental groups to create exclusion zones for certain flora and fauna, in consultation with the community. We can be a lot more flexible in our burn planning than some regions.'

Risk is well under target

While Scott's been doing his fellowship, Simon Brown, Senior Forest Fire Management Officer Fuel Management for the region's Murray Goldfields district, has kept an eye on the region's bushfire risk.

'We're currently at 62.5%, under the risk reduction target of 70%. In 2017–18, we reduced it by 2.5%, so without the year's planned burning we'd be at 65%', Simon says.

'A key burn for risk reduction this year was at Redbank in the Pyrenees', notes Simon.

'We did the burn in the spring, which made the burning riskier, but which avoided smoke taint to the grapes, which the local grape growers appreciated.'

The team also did a burn around Denver in the Hepburn area.

'That was probably the highest-risk-reduction burn in the region. But risk-wise we couldn't do it until autumn, so we had to negotiate with the grape-growing organisations to make sure the grapes were off the vines and do smoke modelling.'

'We really have ramped up our engagement, for the better', says Scott.

'That includes engaging with tourism operators and the general public. Five or six years ago, we had environmental groups that refused to meet with us without a mediator. That's all been turned around. We're communicating smarter.'

'The support for planned burning has always been there', says Simon.

'But we need to be really clear about our objectives and messaging, and with our planned burn risk assessment tools we can be really specific about why we're doing a burn and what compromises we've made.'

Extra care with communities

There's also a greater emphasis on the health of communities in and around burn zones these days.

'We're very, very careful now to make sure that if, say, so-and-so has asthma, we ring them before the burn to tell them. It's in all the burn plans, and a lot of care goes into that side of things.'

They also do a lot of social media before, during and after burns.

'We engage a lot with the public' says Scott.

'At the start of the season, we have meetings with the public and with stakeholders. Leading up to the burn, we'll put out a flyer — something physically people can keep and read — and phone people who have asked to be called, for health or other reasons. We'll put up those moving message board things beside roads, and we also have onsite information points during the burn. And on burning days, will use all possible media to tell people what we doing.'

To top it off, the Loddon Mallee team now uses a plane to alert people along more-remote stretches of the River Murray to the high fire danger.

'The plane drags a banner telling campers — who are maybe out of range or not looking at their phones — it's a total fire ban day', says Scott.

Safe to say, the Loddon Mallee team is getting their fire messages out there loud and clear. You could even say they're flying along.

Port Phillip

Nick Ryan Assistant Chief Fire Officer (acting)

Nick Ryan knows all too well how fast fire can move. In February 2009, a raging bushfire was heading straight for his family's property in Kilmore East. Black Saturday had begun.

'I got about 20 years' experience in one day', says Nick, 'but we saved the house and the main shed. It was tumultuous there for a while.'

These days, Nick's fire experience is all part of his community engagement message across the Port Phillip region.

'If I'm getting somebody to understand about risk, being able to speak from first-hand experience is really valuable', he says.

Community first

While Nick knows the message about being prepared for bushfires is getting through in most places, the problem is that the stark memories can fade.

'As time goes on and we get further from a serious bushfire, we can forget the lessons of the past', he says.

'People down around Cobden and Terang are particularly aware of fire safety at present, they had fires there last summer. But people who haven't had a big fire anywhere near for a while can be a bit dulled to the risks.'

His Black Saturday close call is not Nick's only experience of major fires. When a planned burn got out of control near Lancefield in September 2015, Nick felt the sting of criticism even though it wasn't his region. 'Living up near Kilmore, which is not that far from Lancefield, I got nailed pretty hard', he says.

'Our department was not painted in a very good light after that, so you find yourself not so much defending the department, but you find yourself answering some pretty serious questions. But good things can come from adversity. Our systems and processes and authorisations are a lot more robust since Lancefield,' he says.

Nick says the Port Phillip region lags other regions in working with Traditional Owners, but it's catching up.

'We plan to do some traditional burns in 2018–19', he says. Near Dixons Creek, between Healesville and Kinglake, the Pauls Range program came about through the team's work with Traditional Owners the Wurundjeri Tribe Council. We clearly need to look at and incorporate traditional burning concepts, to help us achieve our objectives', Nick says.

Bushfire risk is OK

Bushfire risk in the Port Phillip region is just under 80%. It's a slight drop from last year Nick considers acceptable.

'It's running at 78% or 79%', he says, 'which is okay, because it takes a major bushfire across the landscape to move it by more than a degree or two a year.'

Nick says focusing on a risk-based target is important. 'At some point, we turn it into a hectare target for operational purposes, and we got about 80% of our hectare target done in 2017–18. But keeping risk under where we want it to be is more important.'

Unlike other regions, Port Phillip was spared the worst of the dry conditions. 'But we still had to hold off a bit before we could start burning, because it was too dry', says Nick.

Dryer conditions can be helpful in the region, which is subject to 'doughy' burns caused by high moisture content. 'When it's 'doughy", the fuel will still burn but it doesn't give us the fuel-reduction result we're looking,' says Nick. 'It smokes and fluffs around, and it doesn't do what you want it to do. That's why the fuel moistures need to be pretty right.'

The team has been making a big effort in Port Phillip's high-priority risk areas during the year.

'The Dandenongs has a high fire risk. If people aren't prepared and have to leave quickly, it can be very challenging. The Warrandyte community — it's bushy and hilly there — get pretty concerned about their level of risk, so we keep a close eye on that area. We did a few planned burns there recently, which helped.'

The heavily populated Mornington Peninsula, which buzzes with locals and visitors in summer, is also a priority. 'The other big one is the water catchments', says Nick.

'If they get burnt, that's got serious consequence for the whole state, even the country.'

Protecting unique assets

The region has some important infrastructure to protect.

'We did some good work to reduce risk to the TV towers on Mount Dandenong', Nick said.

The team also partnered with the CFA in an asset-protection burn around Emerald Secondary College in the east of the Dandenongs.

'There was concern that a fire on a bad day would threaten the college and put the kids at risk', Nick explains. 'So we did a burn adjacent to the college, on a weekend so the kids weren't at school.'

Alerting communities to the presence of burns, and smoke, is a constant, challenging part of the job.

'Smoke this year was a big challenge. We work with the CFA and Melbourne Water to get it right, but when there's a lot of burning going on and the weather doesn't go in our favour, we put up a lot of smoke. This year we had our fair share of criticism because of smoke. Millions of people see what we're doing, so we're going to get complaints: letters to the Minister, people calling us, negative social media feedback. We need to keep working with our partner agencies and keep understanding the total smoke load and where it's going. And if we have a few good days of burning and there's a lot of smoke around, we might back off a little bit to give the community a breather from it.'

Improving ecosystem resilience

Ecological burns are always on the Port Phillip agenda, particularly in the grasslands west of Melbourne.

'Grass burns are relatively easy', says Nick, 'as they don't put up heaps of smoke. They're over pretty quickly. Quite a bit of the Metro district program is grass burns, usually early in the season starting at the end of February or the start of March.'

The year's achievements

Statewide bushfire risk

66% residual risk

In Victoria, there will always be a level of risk for bushfire. We talk about current levels of risk as being the percentage of risk 'left over' after fuel loads in the forest have been reduced – either through fuel management or bushfire.

Our fuel management program is driven by a statewide target to maintain bushfire risk at, or below, 70 per cent of Victoria's maximum bushfire risk. This means that bushfire fuels have been reduced to the point where impacts to life and property are reduced by about a third of the maximum risk.

Victoria's bushfire risk profile (1980 – 2018) tells a story of how bushfire risk changes over time, based on bushfire history and our fuel management activities. We use this information to predict how risk will change because of our future planned burning and compare the effectiveness of different bushfire management strategies. Victoria's fuel management program on public land is driven by a statewide target to maintain bushfire risk at, or below, 70 per cent of Victoria's maximum bushfire risk.

Victoria's bushfire risk increased slightly from last year because of unfavourable weather conditions during the year. Despite the limited opportunity to do planned burning due to poor weather conditions, our risk modelling technology helped us determine places where planned burning would be most effective at reducing risk and Regional bushfire risk
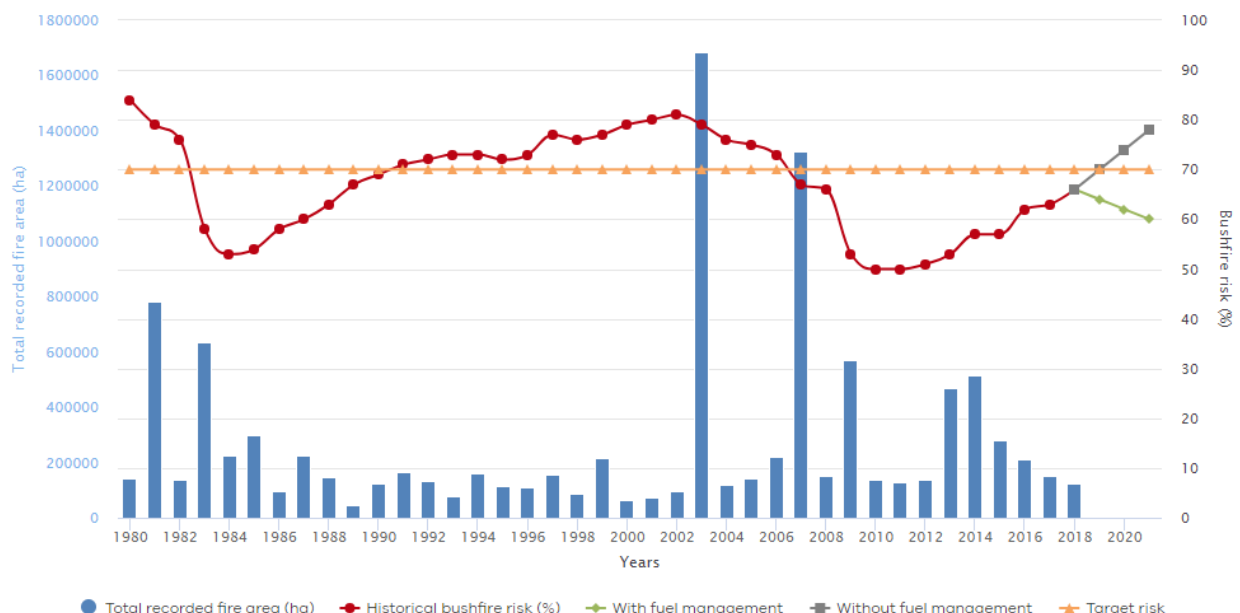

Figure 1: Bushfire risk profile, Victoria, 1980-2021

Victoria's risk profile (Figure 1) shows that bushfire risk:

• Was 66% statewide for 2017-18.

• 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.

- Has increased in recent years as fuel has re-accumulated.

Re-accumulating fuel in Victoria's forests can quickly increase bushfire risk, if the fuel is not properly managed through regular fuel management. If we implement our Joint Fuel Management Program (JFMP) and there is little bushfire activity, modelling indicates that bushfire risk will be maintained at 60% by 2021. If we cannot carry out our planned fuel management activities and there is little bushfire activity, modelling indicates that bushfire risk is likely to rise steeply to 78% over the next three years.

Regional bushfire risk

Mallee and Murray Goulburn
44%
2017-18 Bushfire Risk

West Central
69%
2017-18 Bushfire Risk

Alpine and North East
59%
2017-18 Bushfire Risk

Alpine and Greater Gippsland
52%
2017-18 Bushfire Risk

South Western
55%
2017-18 Bushfire Risk

Statewide
66%
2017-18 Bushfire Risk

Barwon Otway
59%
2017-18 Bushfire Risk

East Central
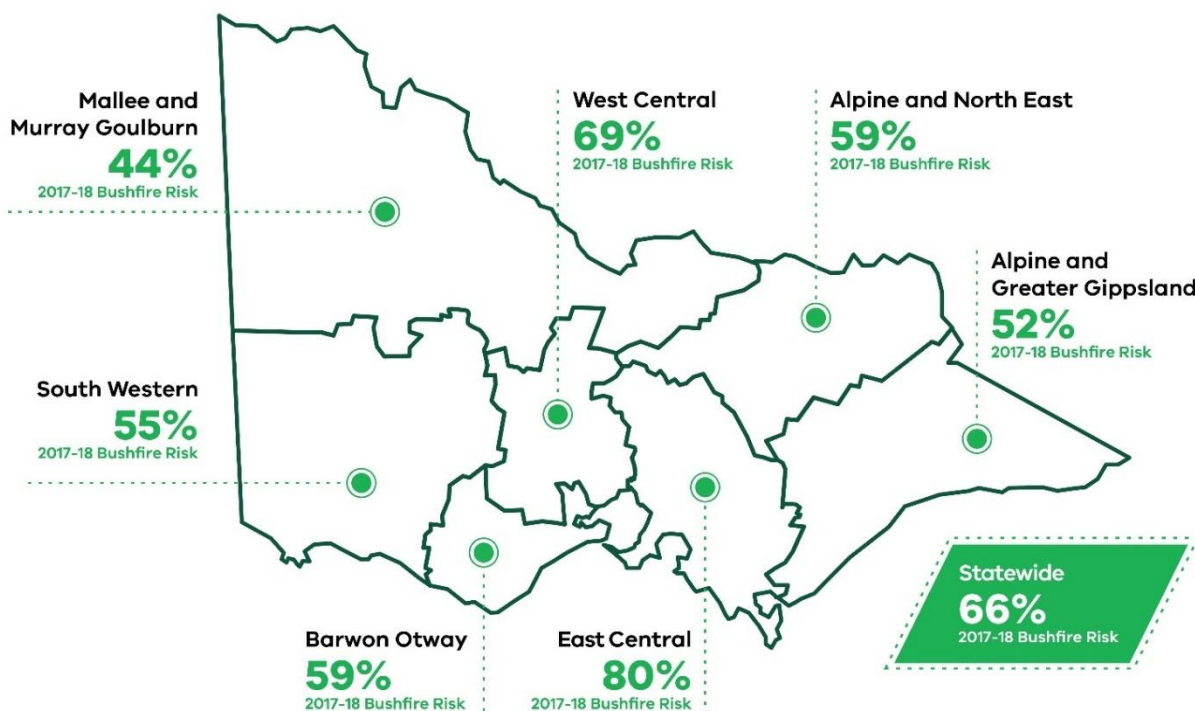**80%**
2017-18 Bushfire Risk

Figure 2: Bushfire risk profiles across Victoria's Bushfire Risk Landscapes

- Bushfire Risk Landscapes (BRLs) are geographical areas of Victoria that are grouped together because bushfires tend to behave in a similar way in those locations. We call them 'risk landscapes'

- There are seven of them across Victoria, and our strategic planning for fuel management is currently based on these areas

- Importantly, risk is different across these different areas – as will be the strategies that we develop with communities to treat that risk

- Currently, risk is calculated and managed using BRL boundaries (Figure 2) while operational activities and management is guided by regional boundaries. This means we work closely across overlapping boundaries to ensure the best risk reduction outcomes for our communities and for maintaining a healthy environment.

Alpine and Northeast

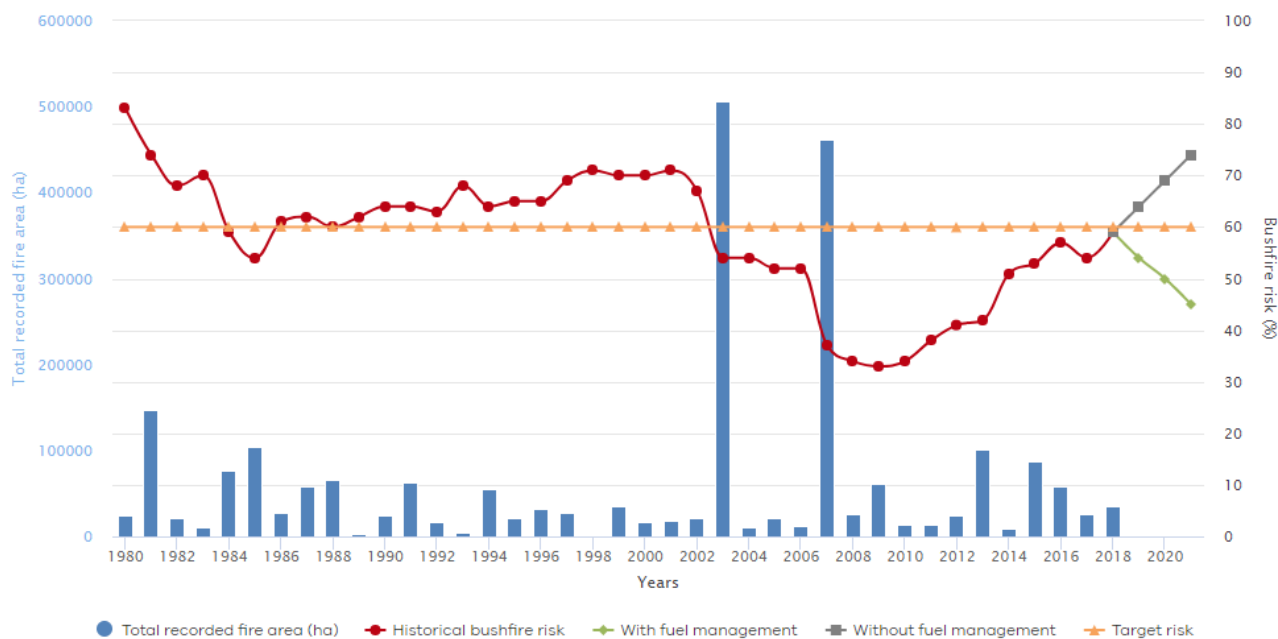<div style="background: green; color: white">

59% residual risk

</div>

Figure 3: Bushfire risk profile, Alpine and North East BRL, 1980–2021

The Alpine and North East BRL risk profile for the period 1980–2018, and projected changes in bushfire risk until 2021 (Figure 3), shows that:

- In 2017-18, bushfire risk in the landscape was 59%.

- Bushfire 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, bushfire 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 bushfire risk below 40% for five years, but in recent years bushfire risk has been increasing again due to fuel re-accumulating in large areas burnt by bushfires.

- Despite restricted conditions for planned burn fuel-reduction activities in 2017–18, we maintained bushfire risk below the 60% target.

- Fuel management activities on the FOP will reduce risk to a projected 45%, but without any fuel management, we project bushfire risk will increase to 74% by 2021.

Aline and Greater Gippsland
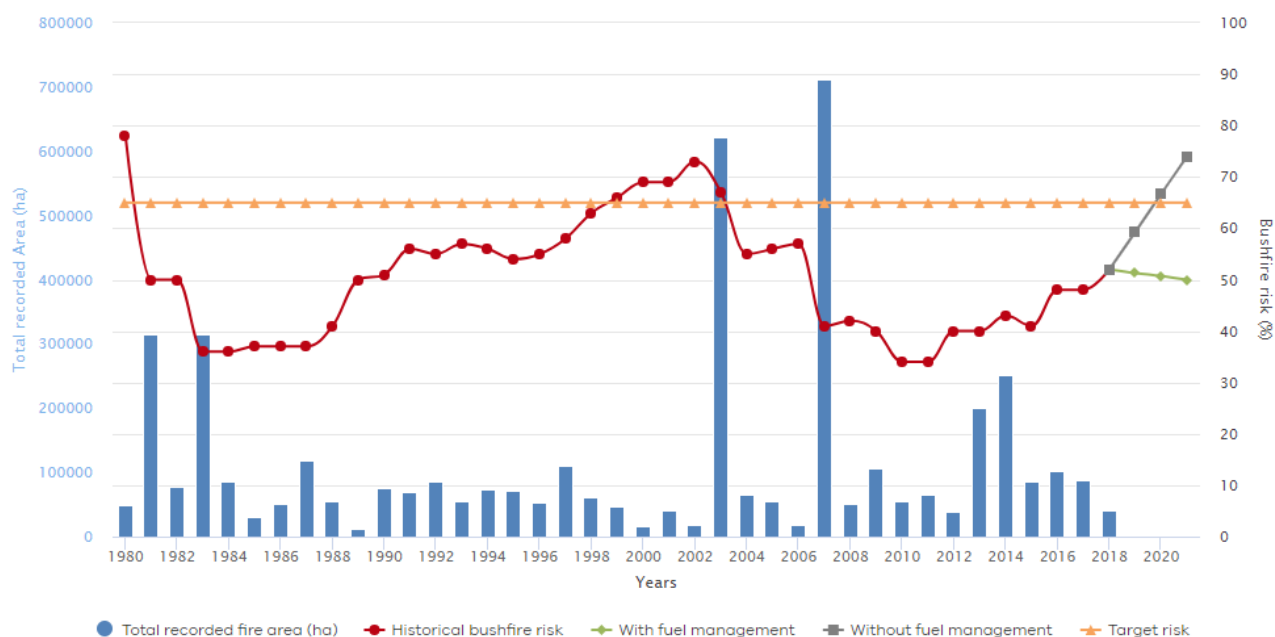
52% residual risk

Figure 4: Bushfire risk profile, Alpine and Greater Gippsland BRL, 1980–2021

The Alpine and Greater Gippsland BRL risk profile for the period 1980–2018, and projected changes in bushfire risk until 2021 (Figure 4), shows that:

- In 2017-18, bushfire risk in the landscape was 52%.

- Bushfire risk fell sharply after major bushfires in the early 1980s and then increased as fuel slowly re-accumulated.

- Bushfire 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 bushfire 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 bushfire risk below the levels seen before the 2003 and 2006–07 bushfires.

- Fuel management activities on the FOP will reduce risk to a projected 50%, but without any fuel management, we project bushfire risk will increase to 74% by 2021.
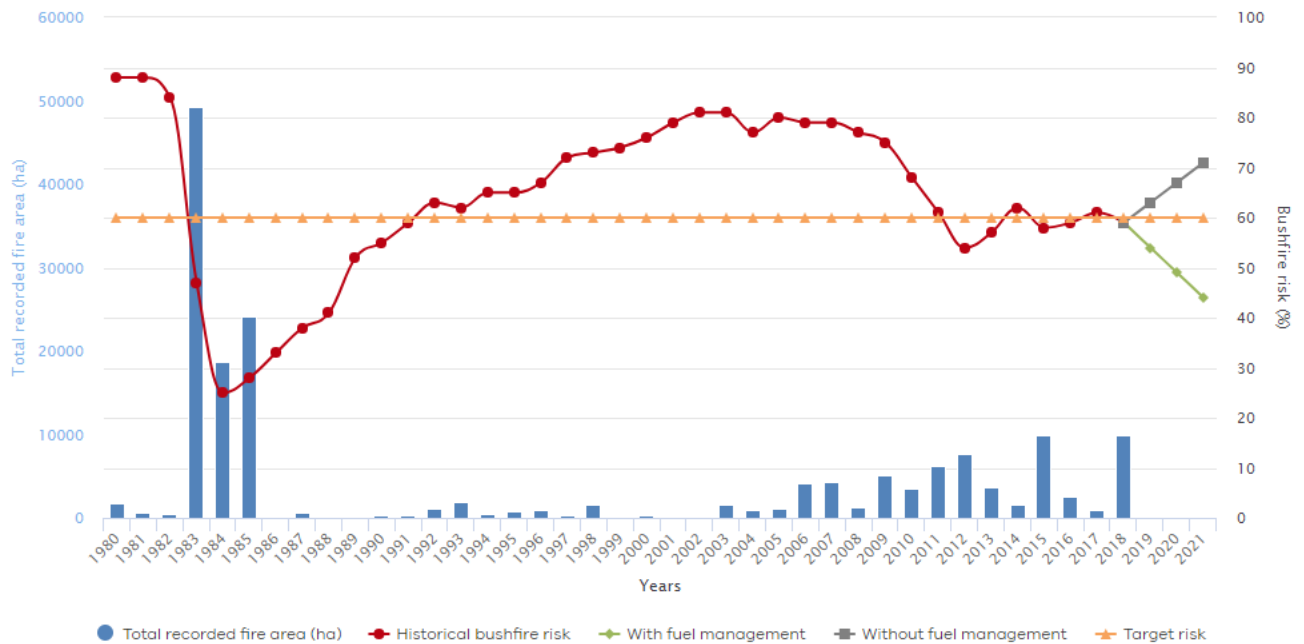
Barwon Otways

59% residual risk

Figure 5: Bushfire risk profile, Barwon Otway BRL, 1980–2021

The Barwon Otway BRL risk profile for the period 1980–2018, and projected changes in bushfire risk until 2021 (Figure 5), shows that:

- In 2017–18, bushfire risk in the landscape was 59%.

- Bushfire risk fell sharply in 1983 after the Ash Wednesday bushfires, which caused devastating losses along the Surf Coast and in the eastern Otways.

- Bushfire risk steadily increased after the Ash Wednesday fires as fuel re-accumulated across the landscape, reaching a peak of 82% in 2003.

- Since 2008, bushfire risk has fallen by 20–25% delivering a strategic, risk-based approach to fuel management.

- Fuel management activities on the FOP will reduce risk to a projected 44%, but without any fuel management, we project bushfire risk will increase to 71% by 2021.
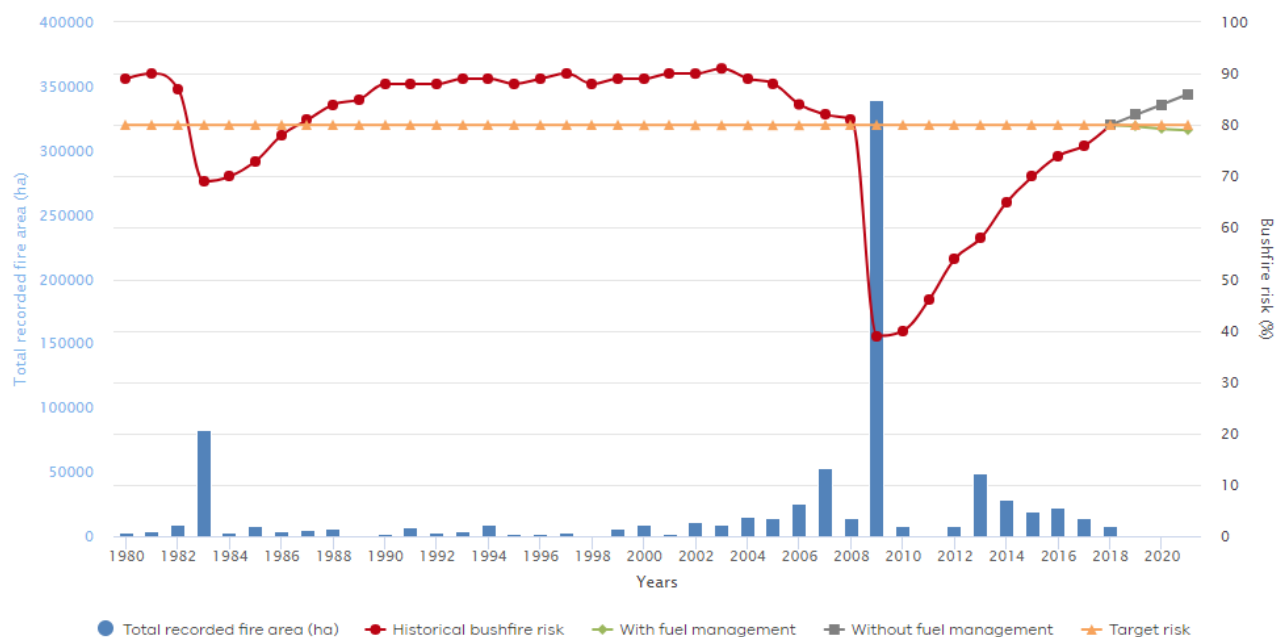
East Central

80% residual risk

Figure 6: Bushfire risk profile, East Central BRL, 1980–2021

The East Central BRL risk profile for the period 1980–2018, and projected changes in bushfire risk until 2021 (Figure 6), shows that:

• In 2017-18, bushfire risk in the landscape was 80%.

• Bushfire 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, bushfire risk has 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. This has made other activities such as mechanical works, improved preparedness and community education essential.

• Fuel management activities in the FOP will reduce risk to a projected 79%, but without fuel management bushfire risk will continue to rise, to a projected 86% by 2021.

Mallee and Murray Goulburn
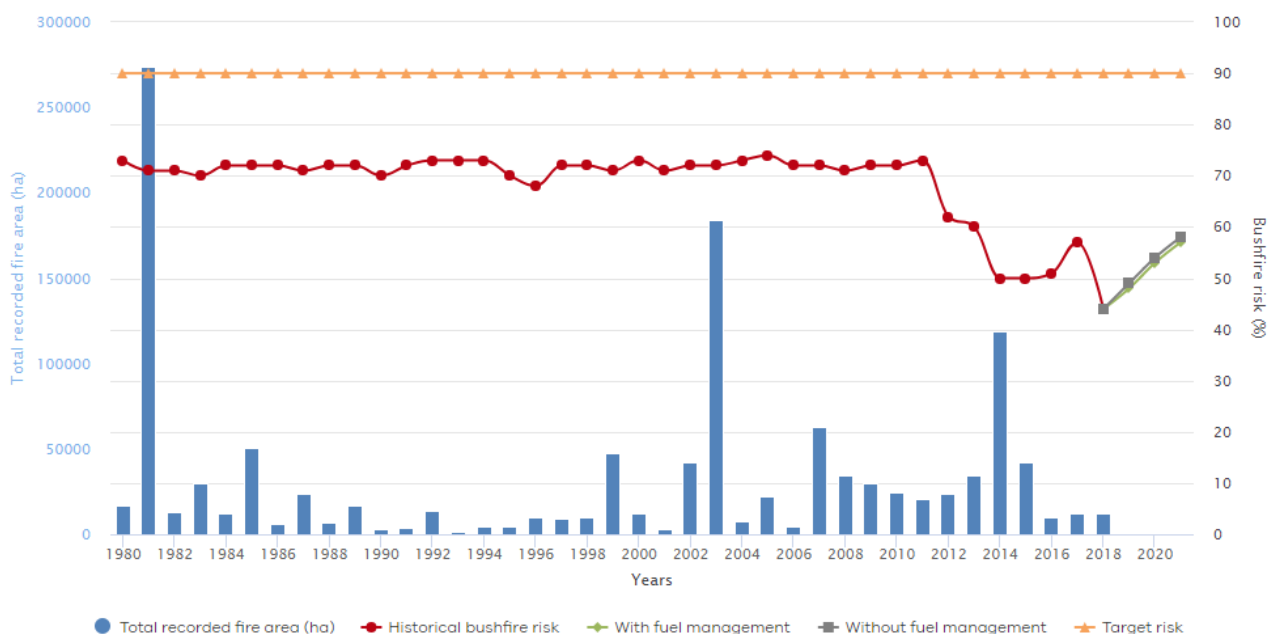
44% residual risk

Figure 7: Bushfire risk profile, Mallee and Murray Goulburn BRL, 1980–2021

The figure above shows the modelled bushfire risk profile for the Mallee and Murray Goulburn BRL for the period 1980–2018, and projected changes in bushfire risk until 2021 (Figure 7). It shows that:

• In 2017-18, bushfire risk in the landscape was 44%.

• Most of the risk is concentrated in a small number of localities, so the risk profile is very sensitive to small changes in fuel around these places. The influential burns around Inglewood, Wedderburn, Tarnagulla and Rushworth in 2017-2018 helped reduce risk.

• More planned burning in smaller, vegetated blocks around larger, higher-risk communities – such as Inglewood, Wedderburn, Tarnagulla and Rushworth – led to a 13% drop in bushfire risk.

• 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.

• If we complete all the fuel management activities on the current Joint Fuel Management Program (JFMP) and there is little bushfire activity, modelling indicates that bushfire risk will be maintained at 57% by 2021. If we cannot carry out any of our planned fuel management activities, modelling indicates that bushfire risk will still increase to 57% within the next three years. This is due to fuels re-accumulating in those influential high-risk areas which were treated in 2017-18, and which cannot be re-burnt within the 3-year JFMP timeframe.

• As fuels reaccumulate in these areas risk levels will rise, but priority burns in high risk areas will maintain community safety at the highest possible level. Areas where risk is returning will be re-burnt once sufficient time has passed for adequate fuel accumulation and/or maintenance of ecosystem health.

South Western

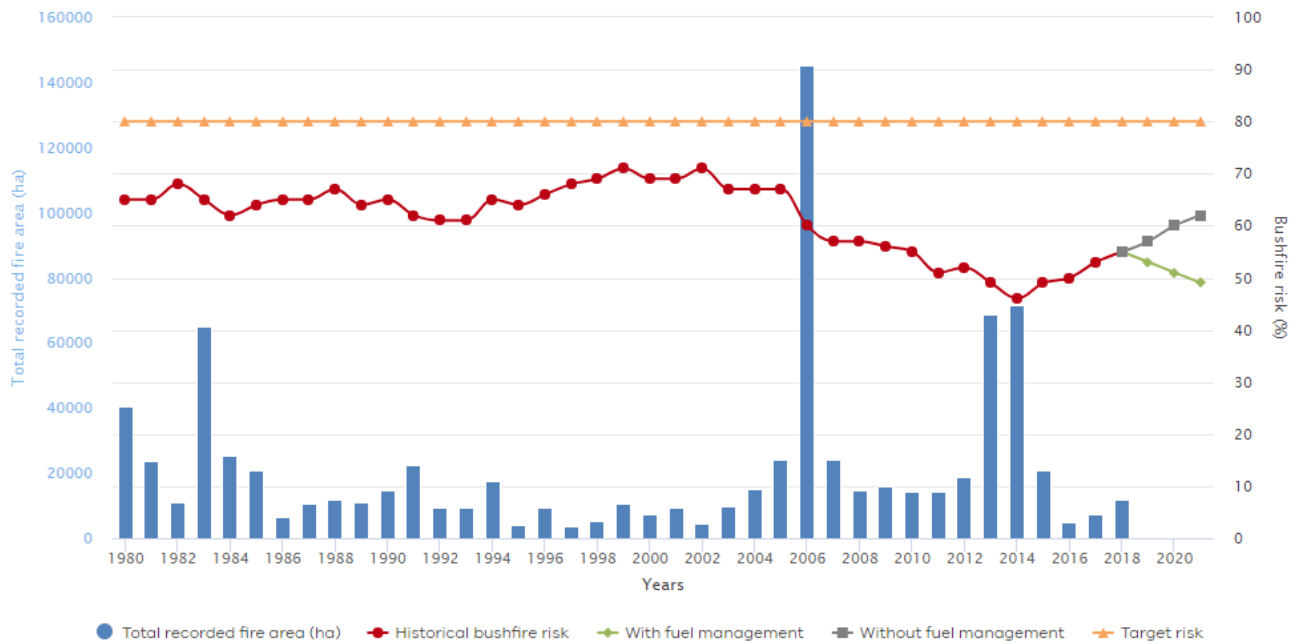<div style="background: green; color: white;">55% residual risk</div>

Figure 8: Bushfire risk profile, South Western BRL, 1980–2021

South Western BRL risk profile for the period 1980–2018, and projected changes in bushfire risk until 2021 (Figure 8), shows that:

• In 2017–18, bushfire risk in the landscape was 55%.

• Bushfire risk was mostly stable after 1980 in the range 60–70%, but it fell sharply to about 57% after the 2006 Mt Lubra bushfire in the Grampians, and it has continued to gradually fall because of planned burning and more-recent bushfires in the Grampians. Bushfire risk has begun to increase in recent years as fuel re-accumulates in these fire-affected areas.

• Fuel management activities on the FOP will reduce risk to a projected 49%, but without any fuel management, we project bushfire risk will increase to 62% by 2021.

West Central

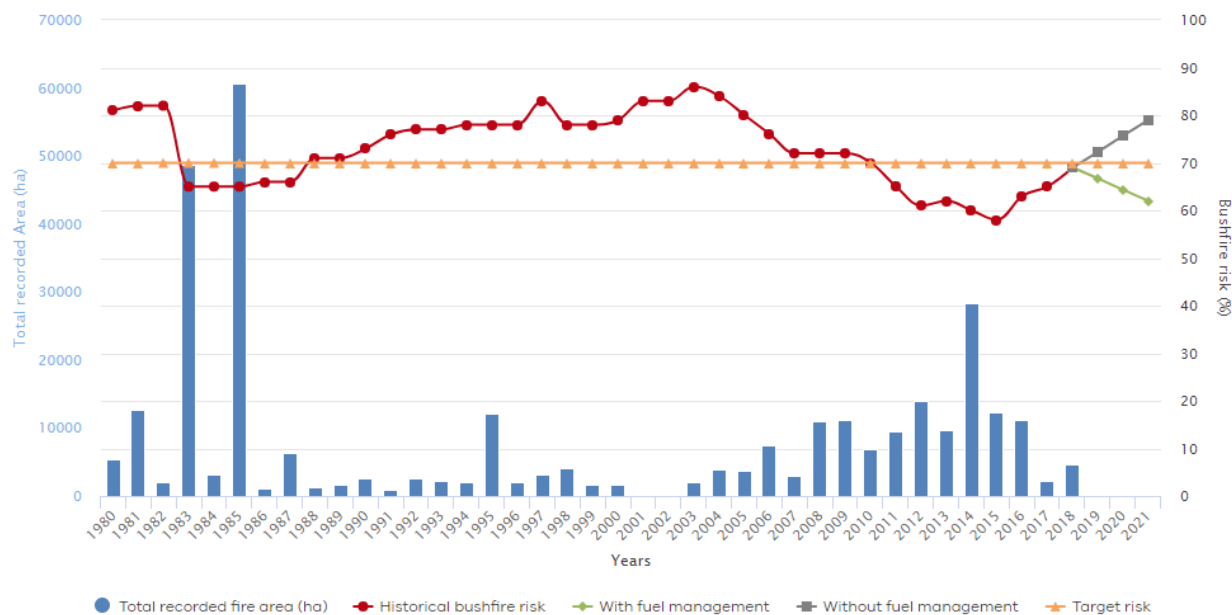<div style="background-color:green; color:white; padding:20px;">69% residual risk</div>

Figure 9: Bushfire risk profile, West Central BRL, 1980–2021

The West Central BRL risk profile for the period 1980–2018, and projected changes in bushfire risk until 2021 (Figure 9), shows that:

- In 2017–18, reduced opportunities for planned burning led to an increase in bushfire risk to 69%.

- Bushfire risk fell sharply in 1983 after the Ash Wednesday bushfires, which caused large losses of life and property in the Mt Macedon area.

- Bushfire 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.

- Fuel management activities on the FOP will reduce risk to a projected 62%, but without any fuel management, we project bushfire risk will increase to 79% by 2021.

Statewide ecosystem resilience

25% vegetation within tolerable fire interval	40% of vegetation within mature or old growth stages

We manage fuel and conduct ecological burns to maintain or improve ecosystem resilience. Ecosystem resilience is the environment's ability to bounce back after fire.

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 our 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 2017-18, we continued testing and refining our method for calculating geometric mean abundance, which will be adopted statewide in the future.

Tolerable fire interval across Victoria

The figure below shows the tolerable fire interval (TFI) status since 2007 of the vegetation on public land across Victoria (Figure 10). It shows about 50% of the vegetation was below its minimum TFI in 2017-18, 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 increased in 2017-2018 to 25%. Substantial areas of fire-affected vegetation in the Alpine North East and Alpine Greater Gippsland have reached reproductive maturity and have shifted into the within TFI categories, influencing the statewide TFI trends. This is a result of our strategic planning to reduce the effects of the planned burning program on TFI and on ecosystem resilience more broadly.
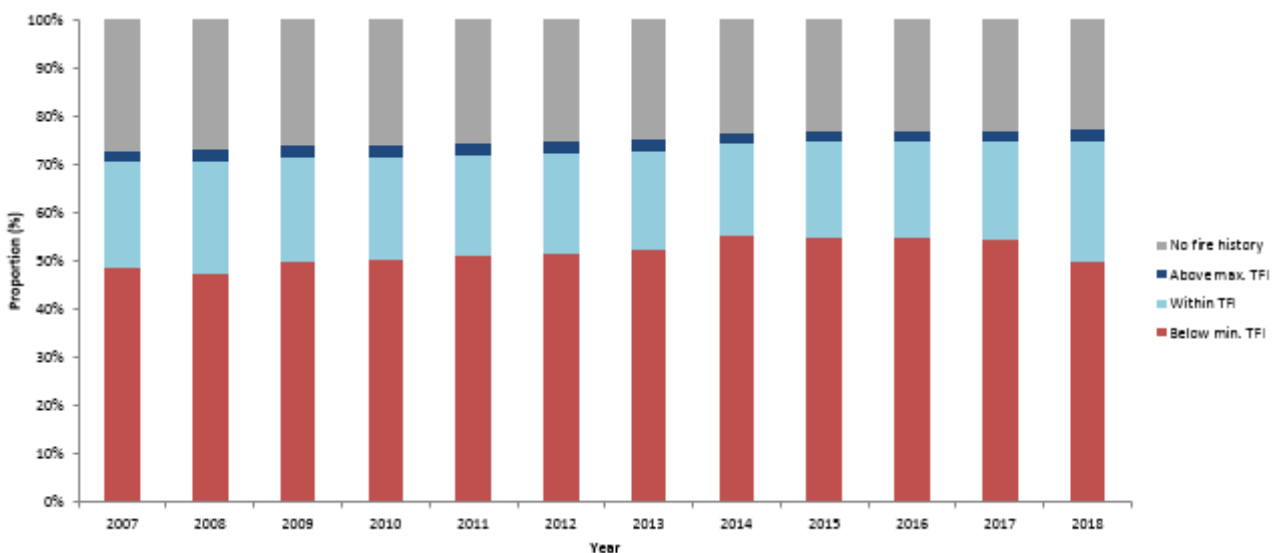
Figure 10: TFI status of public land vegetation, Victoria, 2007–18

The figure below shows the area of public land burnt by bushfires or planned burning while below minimum TFI in the period 2007–18 (Figure 11). 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. We continued to see a multi-year decline in the overall area burnt by bushfire or planned burning while below minimum TFI. In 2017-18, less than 1% of the vegetation in Victoria was burnt while below TFI. The total area burnt while below minimum TFI in 2017–18 was lower than the previous year. Despite increases in the area burnt by bushfires while below minimum TFI, most of this reduction is the result of carefully targeted planned burning.
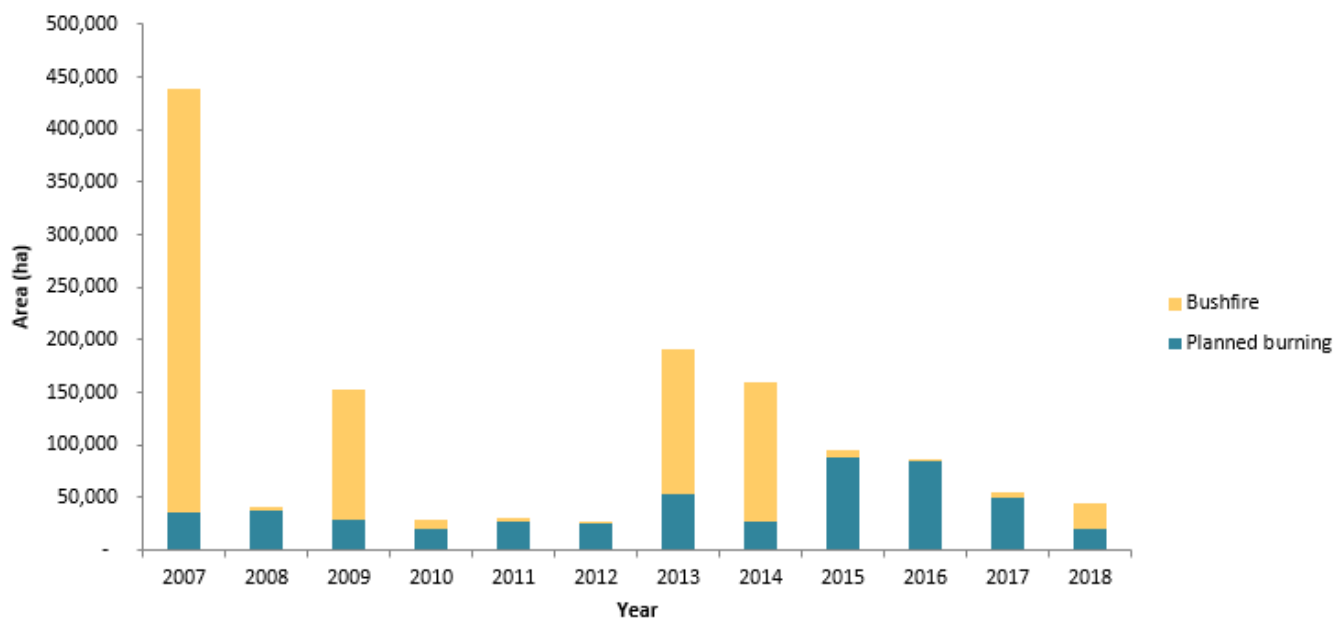

Figure 11: Area of public land burnt while below minimum TFI, Victoria, 2007–18

The figure below shows the area of each fire management zone treated by planned burning while below minimum TFI between 2008–18 (Figure 12). The next figure shows the proportion of each zone treated by planned burning while below minimum TFI over the same period (Figure 13).

The figure below shows the greatest areas treated while below minimum TFI are in Landscape Management Zone (LMZ) and Bushfire Management Zone (BMZ), with smaller areas treated in Asset Protection Zones (APZs). However, the next figure 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 2017-18 (<5%). This shows our strategic bushfire 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.
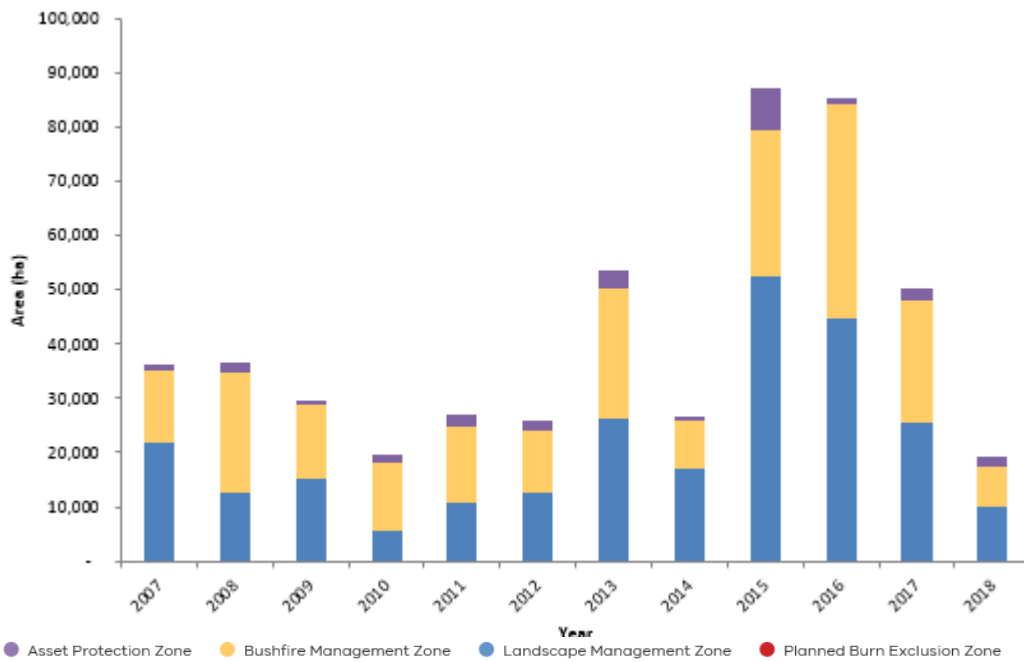
Figure 12: Area treated by planned burning while below minimum TFI, by fire management zone, 2008–18
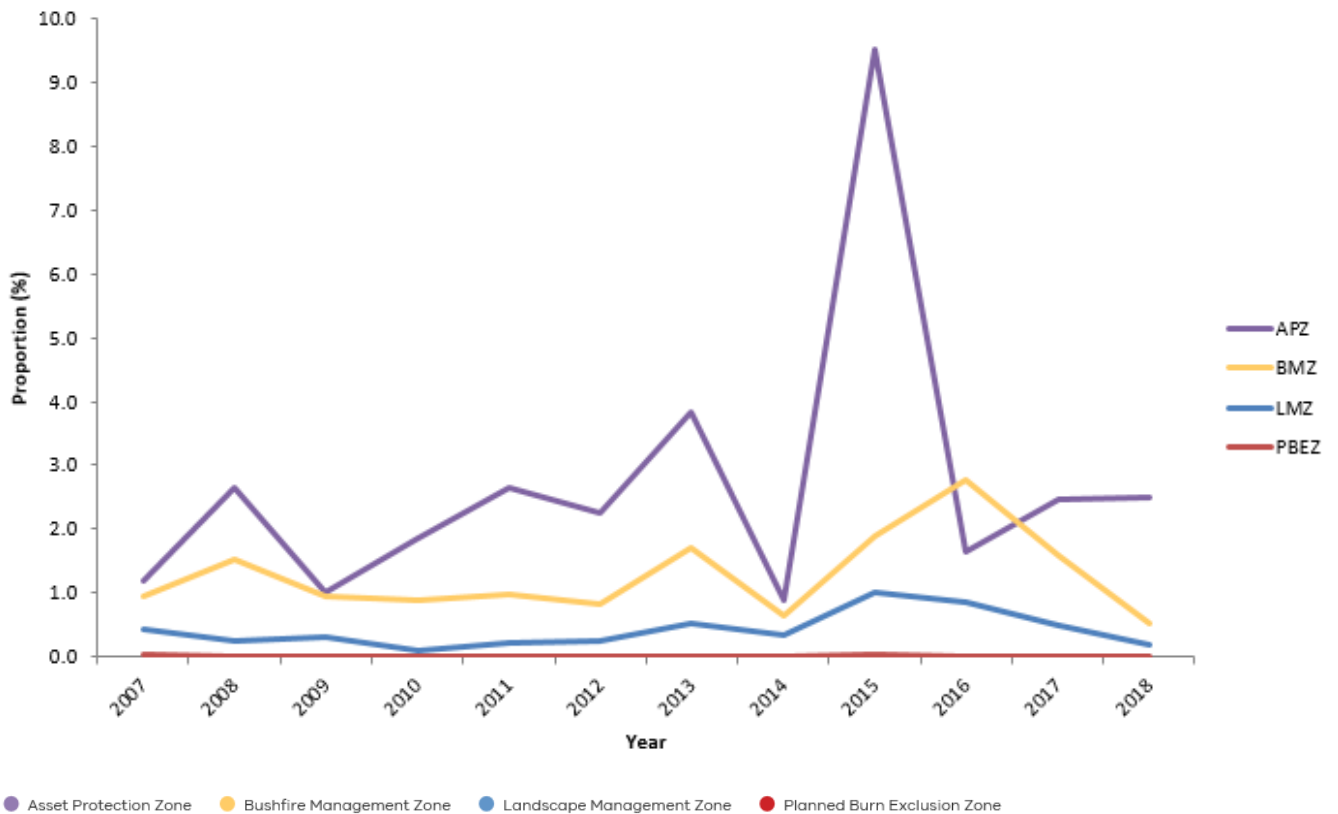

Figure 13: Proportion of each fire management zone treated by planned burning while below minimum TFI, 2007–18

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 more accurately.

Growth stage structure across Victoria

This figure below shows changes in statewide vegetation growth stage structure (GSS) in the period 2007–18 (Figure 14). 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 2017) to the adolescent growth stage, however the most substantial shift has been from the adolescent growth stage (down by 6% since 2017) to the mature growth stage (up by 8% since 2017).

A relatively high proportion (about 23%) 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.
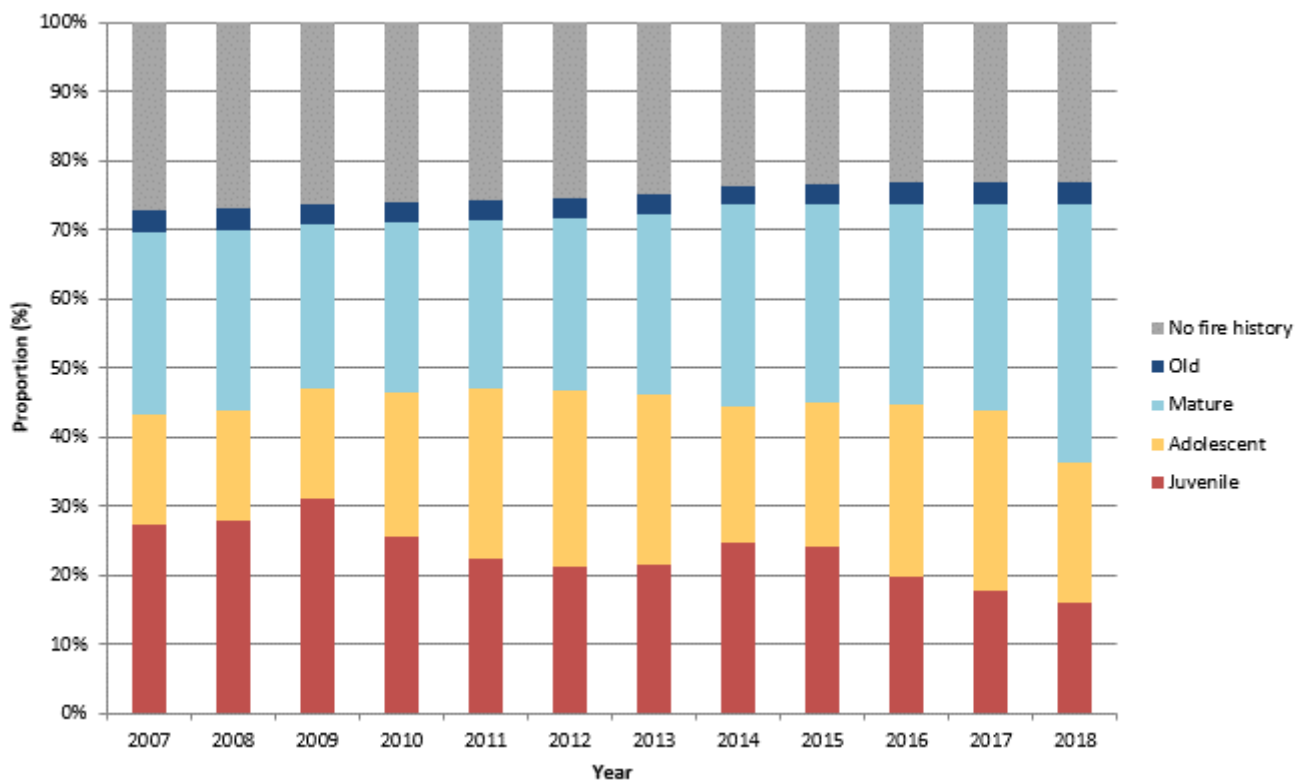

Figure 14: GSS status of vegetation on public land, Victoria, 2007–18

Regional ecosystem resilience

Alpine and Greater Gippsland

23% vegetation within tolerable fire interval	35% of vegetation within mature or old growth stages

The figure below shows the tolerable fire interval (TFI) status of the vegetation on public land in the Alpine and Greater Gippsland BRL for the period 2007–18 (Figure 15).

The figure shows that in 2017–18 about 66% 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 until 2018 where we see a 5% decrease in area below minimum TFI. During 2017–18, only 1.2% of the vegetation in the landscape was burnt while below minimum TFI. This shows that our fire management strategies are carefully considering and planning our burns to reduce the impacts on vegetation below minimum TFI.
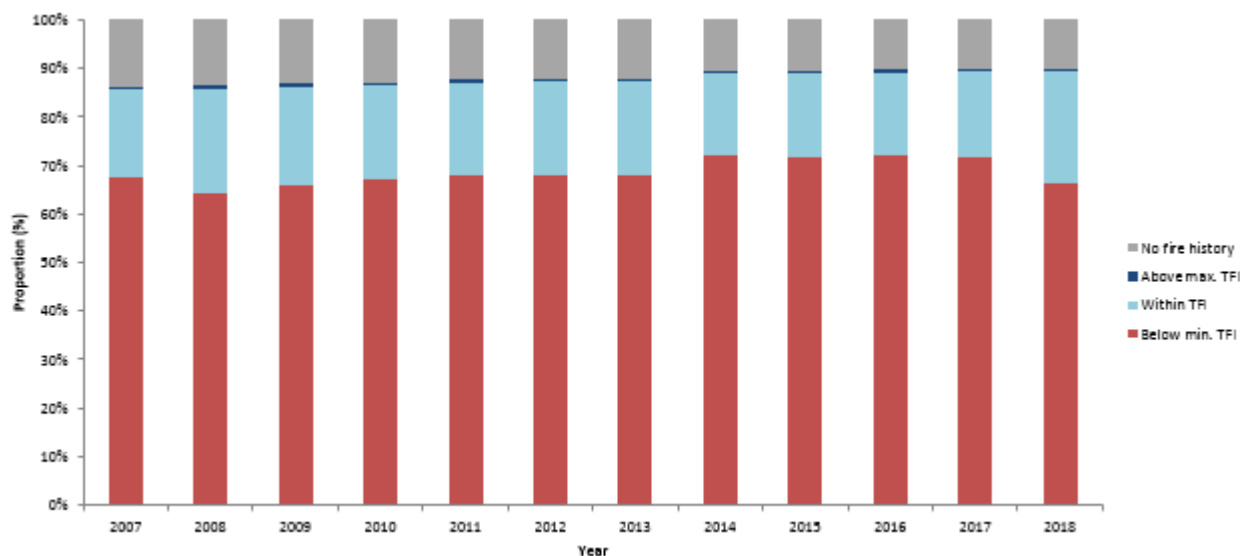
Figure 15: TFI status of public land vegetation, Alpine and Greater Gippsland BRL, 2007–18

The figure below shows the growth stage structure (GSS) status of the vegetation on public land in the Alpine and Greater Gippsland BRL for the period 2007–18 (Figure 16).

The figure shows about 56% of the landscape was in the juvenile and adolescent growth stages in 2017–18. 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 fire 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%. However, in 2017-18 an increase to about 35% was observed, as substantial areas of fire-affected vegetation in the Alpine and Greater Gippsland reached reproductive maturity. 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.
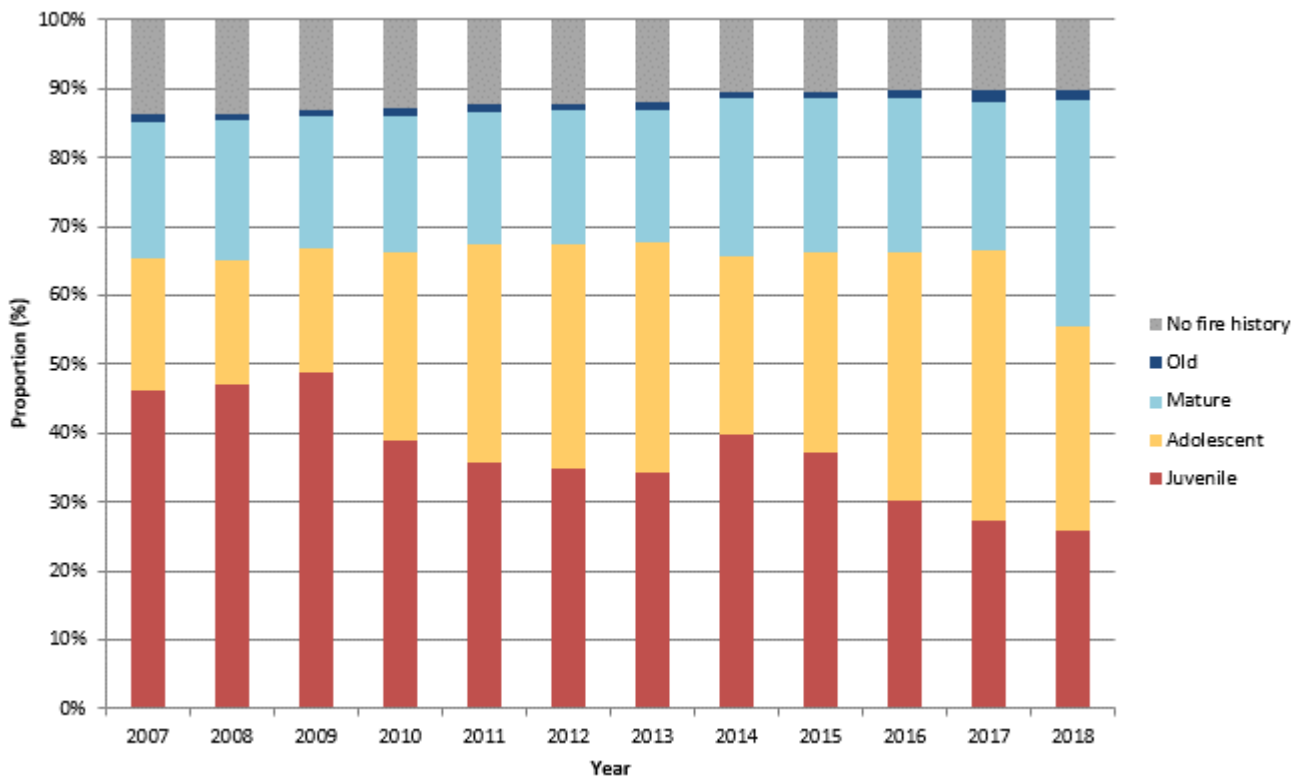
Figure 16: GSS status of public land vegetation, Alpine and Greater Gippsland BRL, 2007–18

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.

Alpine and Northeast

25% vegetation within tolerable fire interval	45% of vegetation within mature or old growth stages

The figure below shows the tolerable fire interval (TFI) status of vegetation on public land in the Alpine and North East BRL for the period 2007–18 (Figure 17).

The figure shows that in 2017–18 about 61% 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. In 2017-18, a 13% increase in vegetation within TFI was observed, as substantial areas of fire-affected vegetation in the ANE reached reproductive maturity. In 2017–18, less than 1% of the vegetation in this landscape was burnt by bushfire or planned burning while below TFI. This shows that our fire management strategies are carefully considering and planning our burns to reduce our impacts on vegetation below minimum TFI.

Figure 17: TFI status of public land vegetation, Alpine and North East BRL, 2007–18

The figure below shows the growth stage structure (GSS) status of vegetation on public land in Alpine and North East for the period 2007–18 (Figure 18).

The figure shows about 43% of the landscape was in the juvenile and adolescent growth stages in 2017–18. In recent years, the proportion of vegetation in the mature and old growth stages has increased to about 45% of the landscape, as large areas of fire-affected vegetation have reached maturity.

Figure 18: GSS status of public land vegetation, Alpine and North East BRL, 2007–18

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.

Barwon Otways

The figure below shows the tolerable fire interval (TFI) status of vegetation on public land in the Barwon Otway BRL for the period 2007–18 (Figure 19).

The figure shows that about 25% of the vegetation is below minimum TFI, and that the area of vegetation below minimum TFI has steadily increased since 2007. In 2017–18, a small 314 ha area was burnt by planned burning while below minimum TFI, and 2 ha area was burnt by bushfires while below minimum TFI. This shows that our fire management strategies are carefully considering and planning our burns to reduce our impacts on vegetation below minimum TFI.
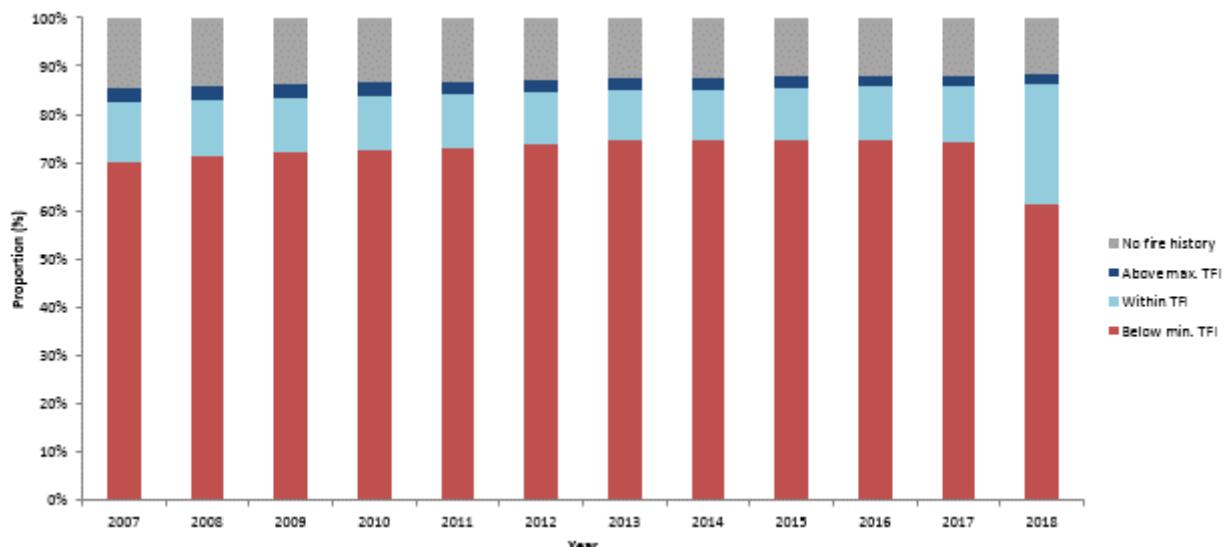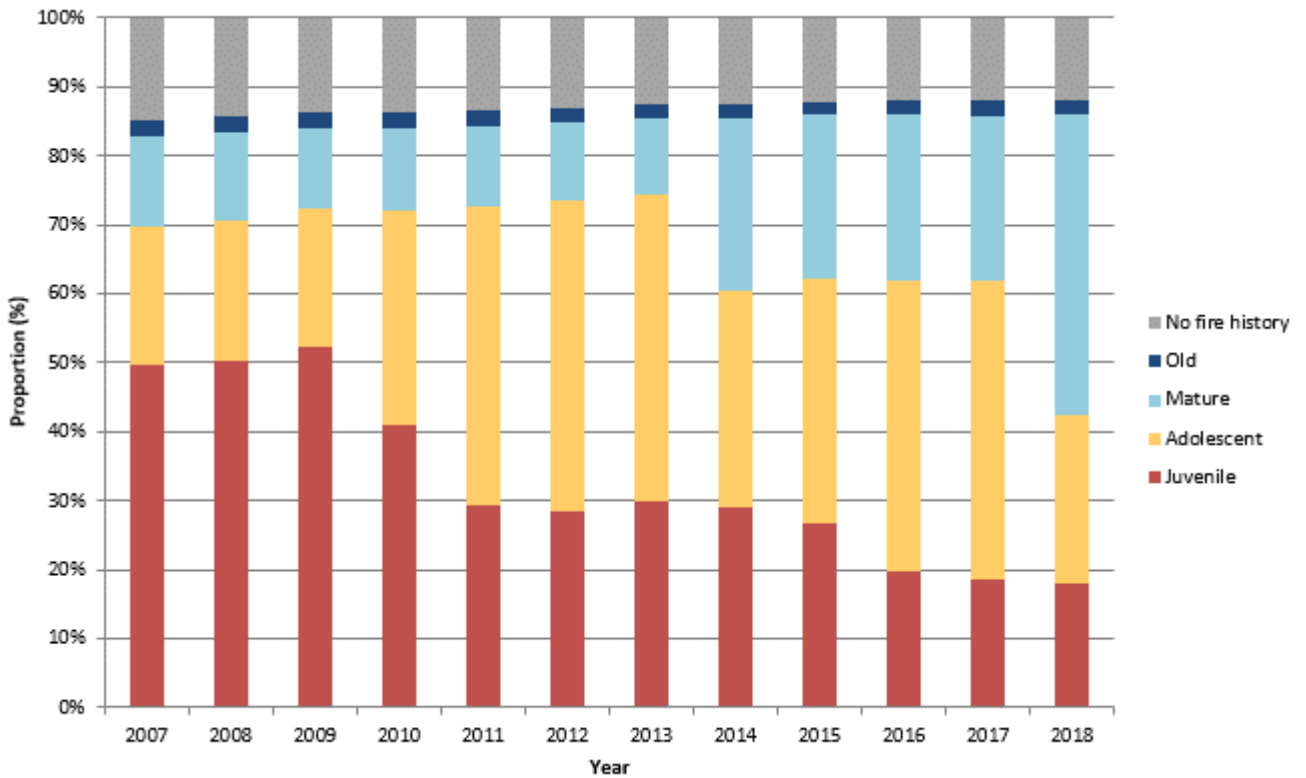

Figure 19: TFI status of public land vegetation, Barwon Otway BRL, 2007–18

The figure below shows the growth stage structure (GSS) status of vegetation on public land in the Barwon Otway BRL for the period 2007–18 (Figure 20).

The figure shows about 18% of the landscape was in the juvenile and adolescent growth stages in 2018 with a 2% increase in adolescent growth stage from the year prior. 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 44% in 2017–18.

The current area below TFI and the proportion of the landscape in the younger and older growth stages is within the acceptable range set out in the Barwon Otway'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.

Figure 20: GSS status of public land vegetation, Barwon Otway BRL, 2007–18

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.

East Central

21% vegetation within tolerable fire interval

40% of vegetation within mature or old growth stages

The figure below shows the tolerable fire interval (TFI) status of vegetation on public land in the East Central BRL for the period 2007–18 (Figure 21).

The figure shows that in 2017–18 about 64% of the vegetation was below minimum TFI. This percentage has been almost the same since 2009. In 2017–18, 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 bushfire 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.
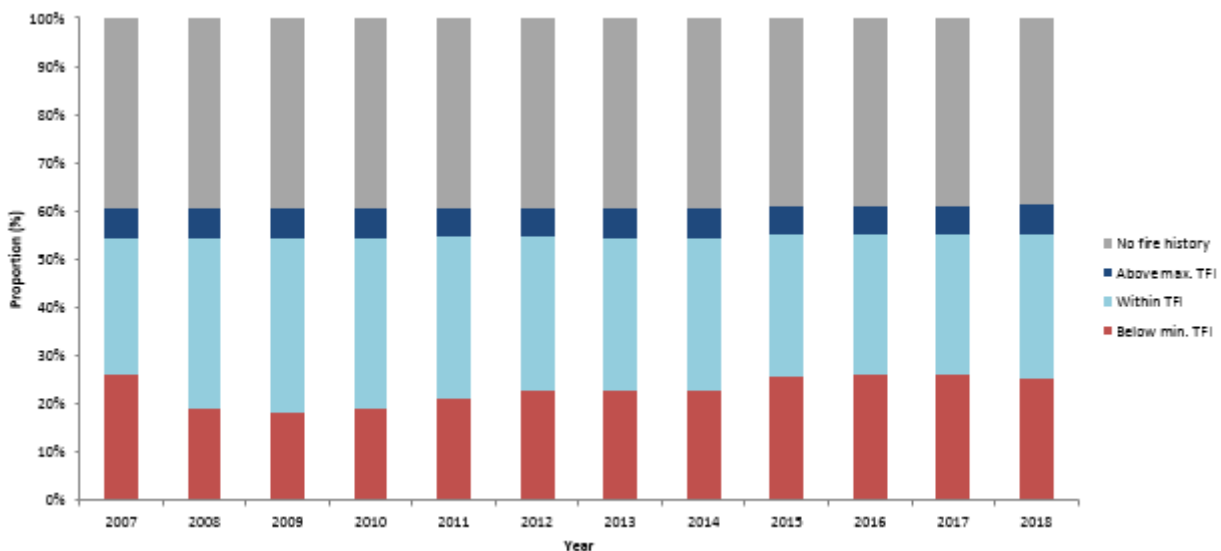

Figure 21: TFI status of public land vegetation, East Central BRL, 2007–18

The figure below shows the growth stage structure (GSS) status of vegetation on public land in the East Central BRL for the period 2007–18 (Figure 22).

The figure shows about 48% of the landscape was in the juvenile and adolescent growth stages in 2018 and about 40% 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.
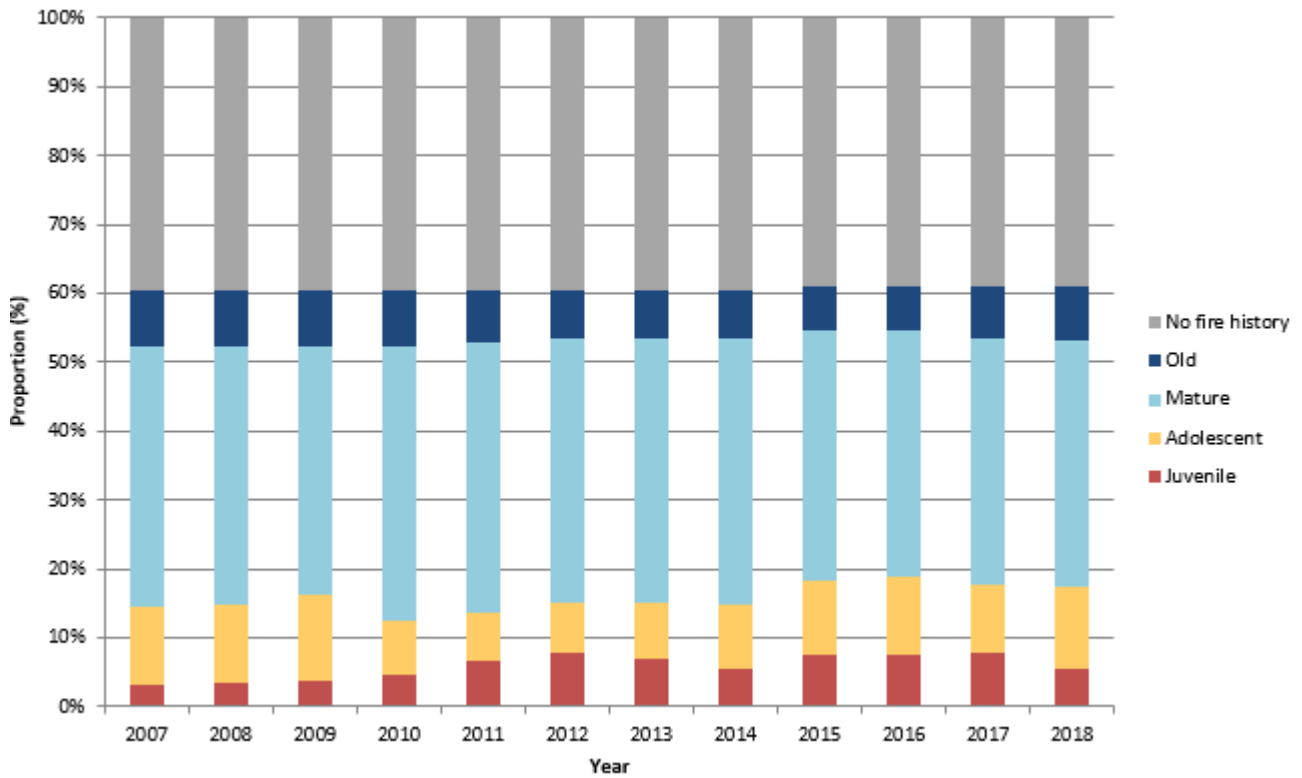
Figure 22: GSS status of public land vegetation, East Central BRL, 2007–18

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.

Mallee and Murry Goulburn

| 29% vegetation within tolerable fire interval | 46% of vegetation within mature or old growth stages |

The figure below shows the tolerable fire interval (TFI) status of vegetation on public land in the Mallee and Murray Goulburn BRL for the period 2007–18 (Figure 23).

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.

The figure below shows the amount of the vegetation below minimum TFI in 2018 was 27%, with a 2% increase in the amount of vegetation within TFI. In 2017–18, less than 1% of the vegetation was burnt by bushfire or planned burning while below minimum TFI. This shows our strategic bushfire 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.
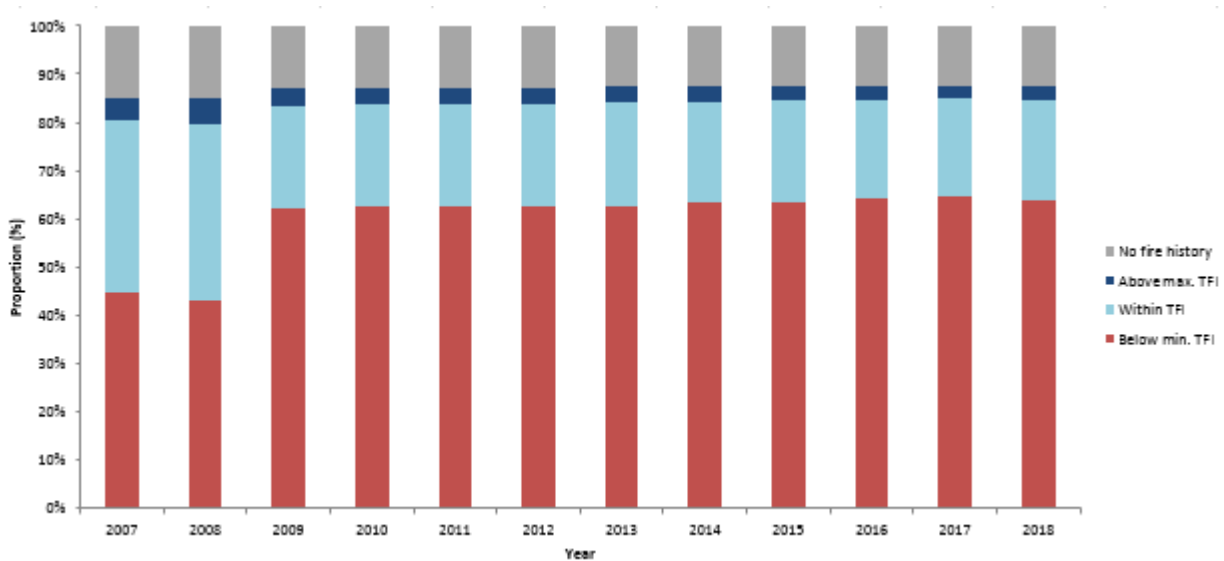

Figure 23: TFI status of public land vegetation, Mallee and Murray Goulburn BRL, 2007–18

The figure below shows the growth stage structure (GSS) status of vegetation on public land in the Mallee and Murray Goulburn BRL for the period 2007–18 (Figure 24).

The figure below 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 12%, while the proportion of mature and old vegetation has risen from about 33% to about 46%. 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 needs to be approaching 90%.
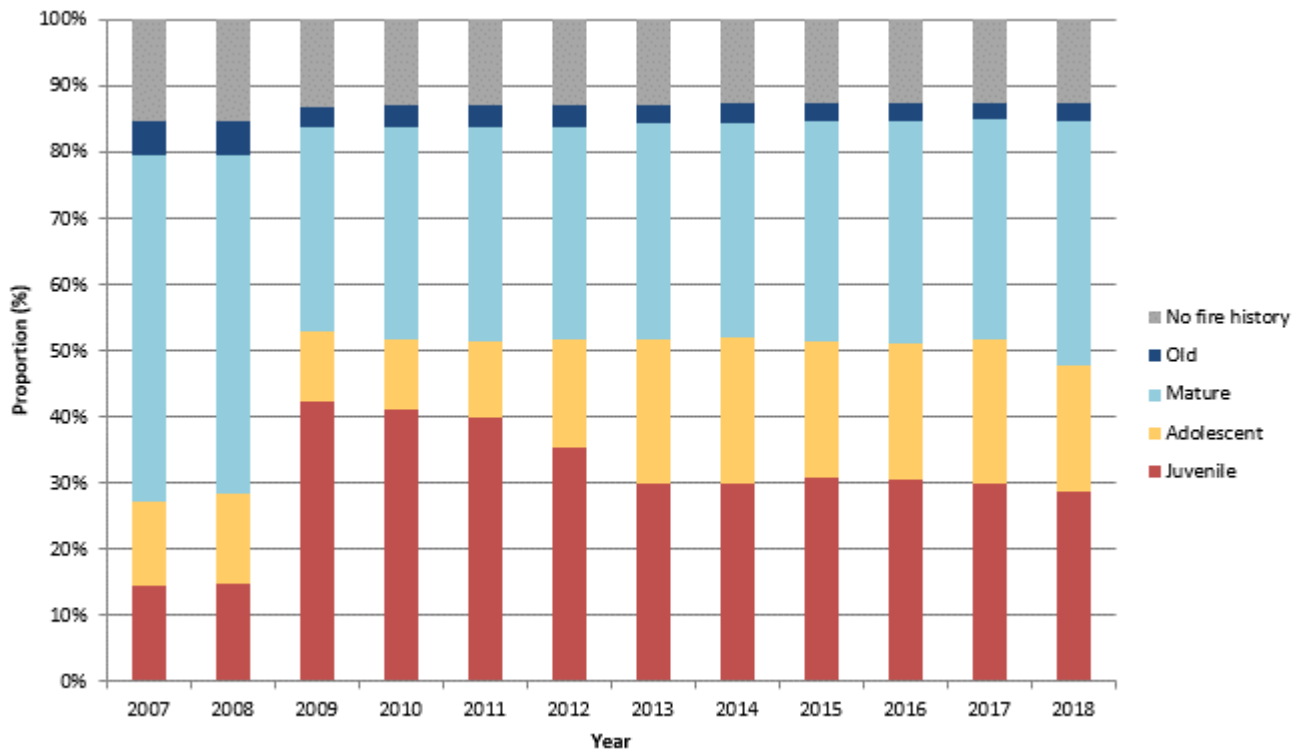
Figure 24: GSS status of public land vegetation, Mallee and Murray Goulburn BRL, 2007–18

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.

South Western

25% vegetation within tolerable fire interval

45% of vegetation within mature or old growth stages

The figure below shows the tolerable fire interval (TFI) status of vegetation on public land in the South Western BRL for the period 2007–18 (Figure 25).

The figure shows that in 2017–18, 40% 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 2017–18, about 1720 ha of the vegetation was burnt by bushfires or planned burning while below minimum TFI. We use strategic fuel management planning to carefully undertake planned burning to reduce impacts on vegetation below minimum TFI.
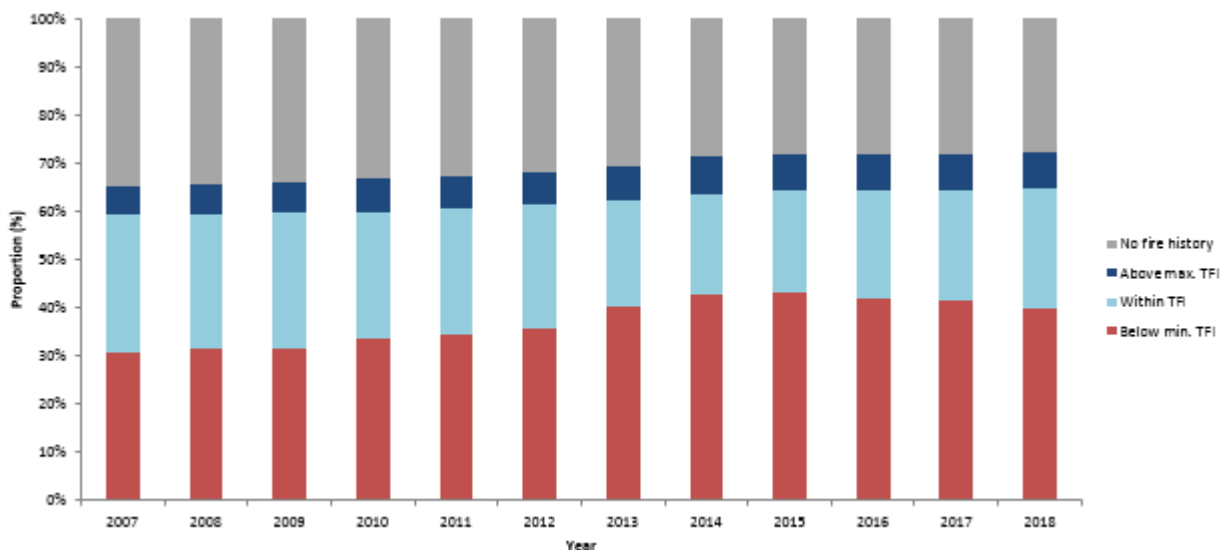
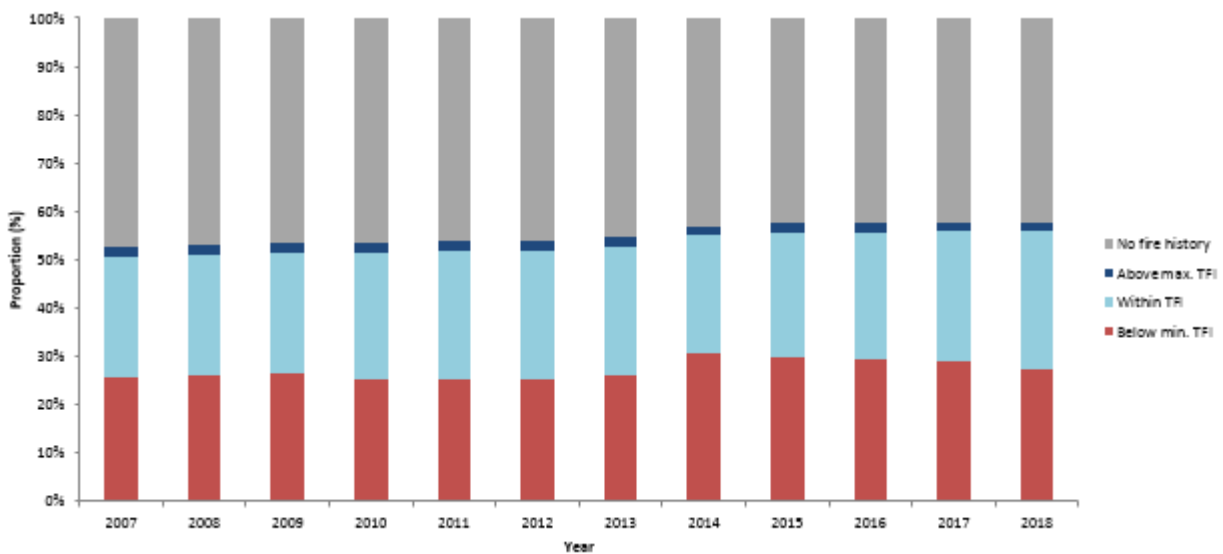**Figure 25: TFI status of public land vegetation, South Western BRL, 2007–18**

The figure below shows the growth stage structure (GSS) status of vegetation on public land in the South Western BRL for the period 2007–18 (Figure 26).

The figure shows that in 2017–18, 27% of the landscape was in the juvenile and adolescent growth stages, and about 45% 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.
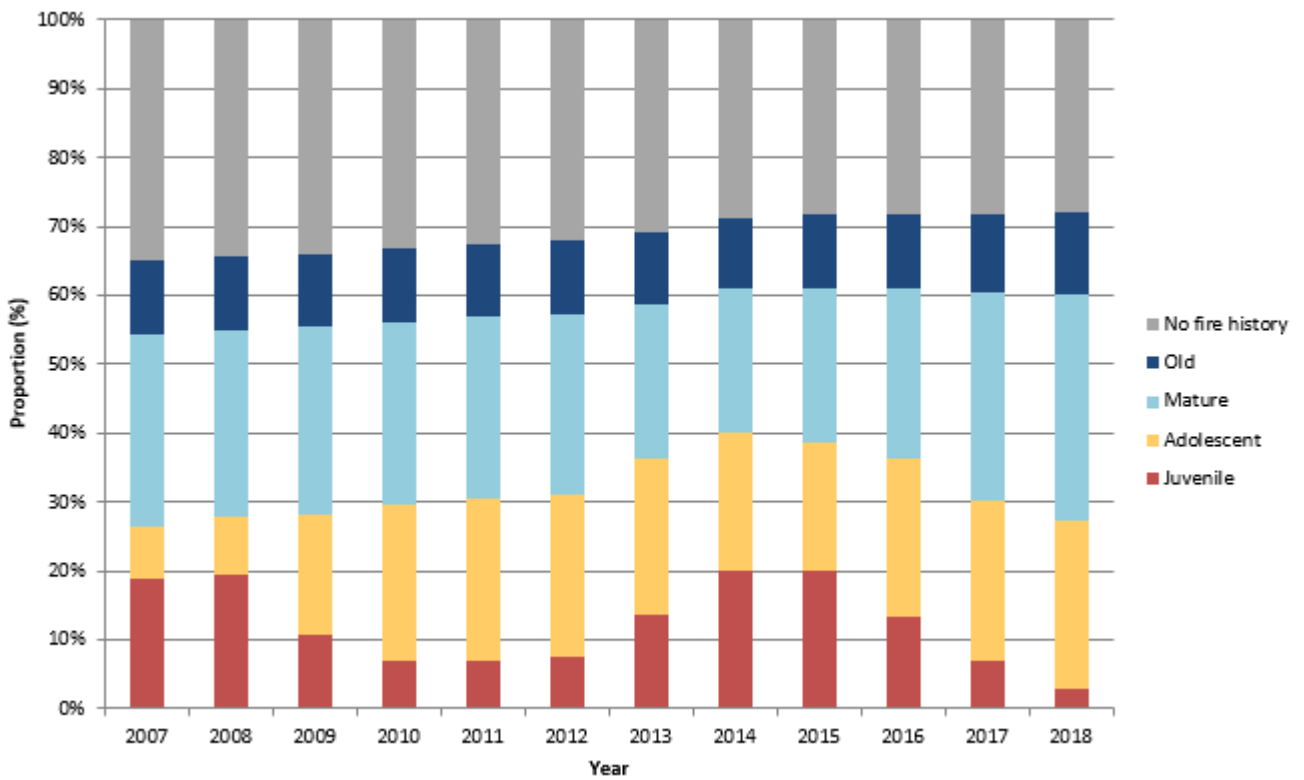
Figure 26: GSS status of public land vegetation, South Western BRL, 2007–18

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.

West Central

The figure below shows the tolerable fire interval (TFI) status of vegetation on public land in the West Central BRL for the period 2007–18 (Figure 27).

The figure shows that in 2017–18 about 28% 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 2017–18, a small (about 434 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.
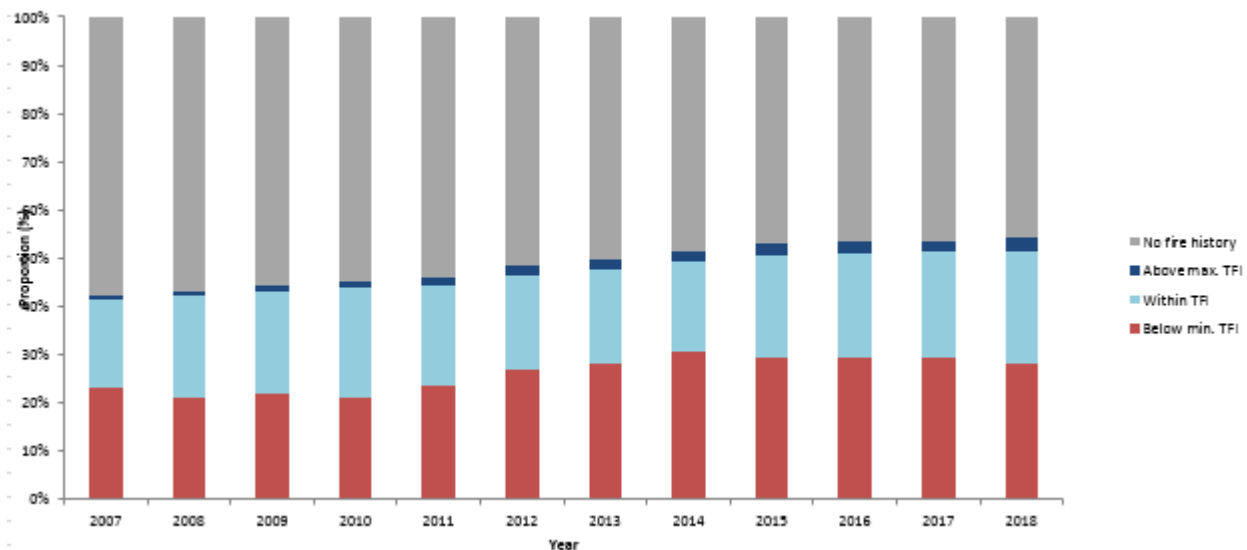
Figure 27: TFI status of public land vegetation, West Central BRL, 2007–18

The figure below shows the growth stage structure (GSS) status of vegetation on public land in the West Central BRL for the period 2007–18 (Figure 28).

The figure shows 29% of the landscape was in the juvenile and adolescent growth stages in 2017–18, 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.
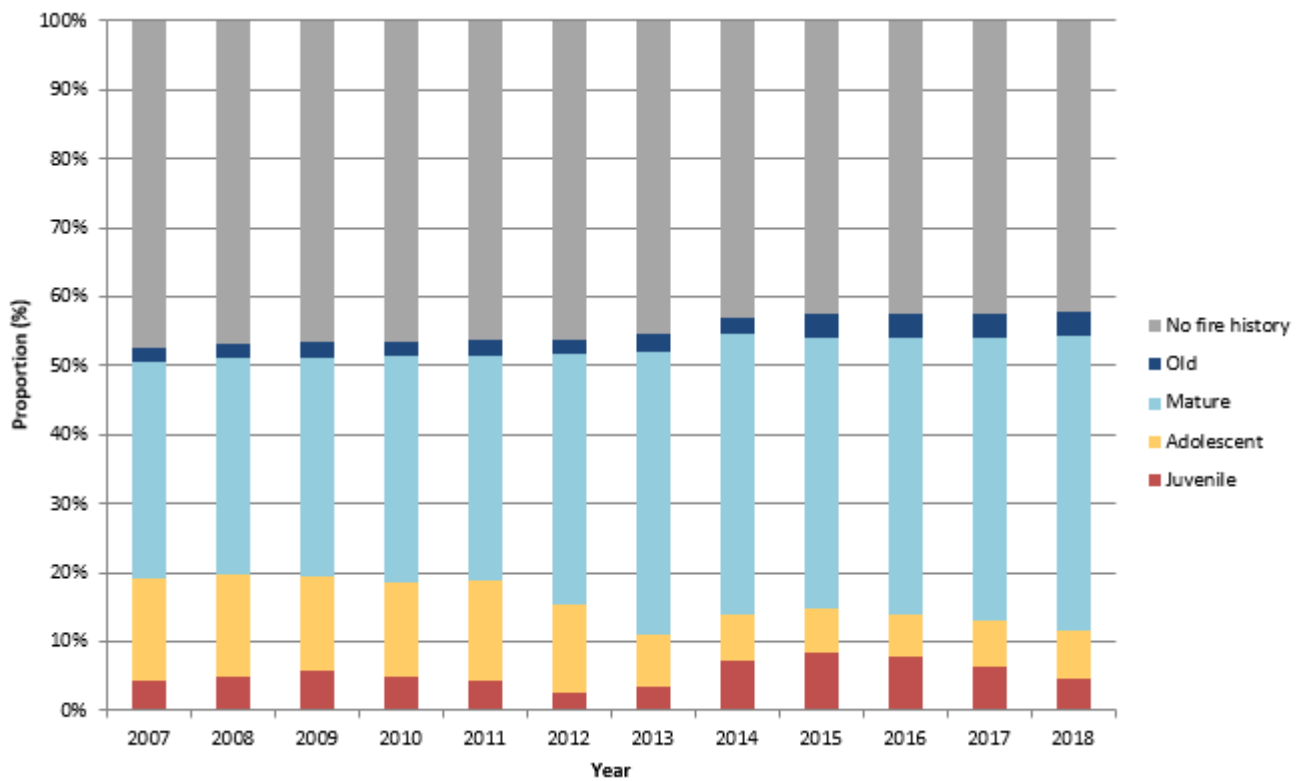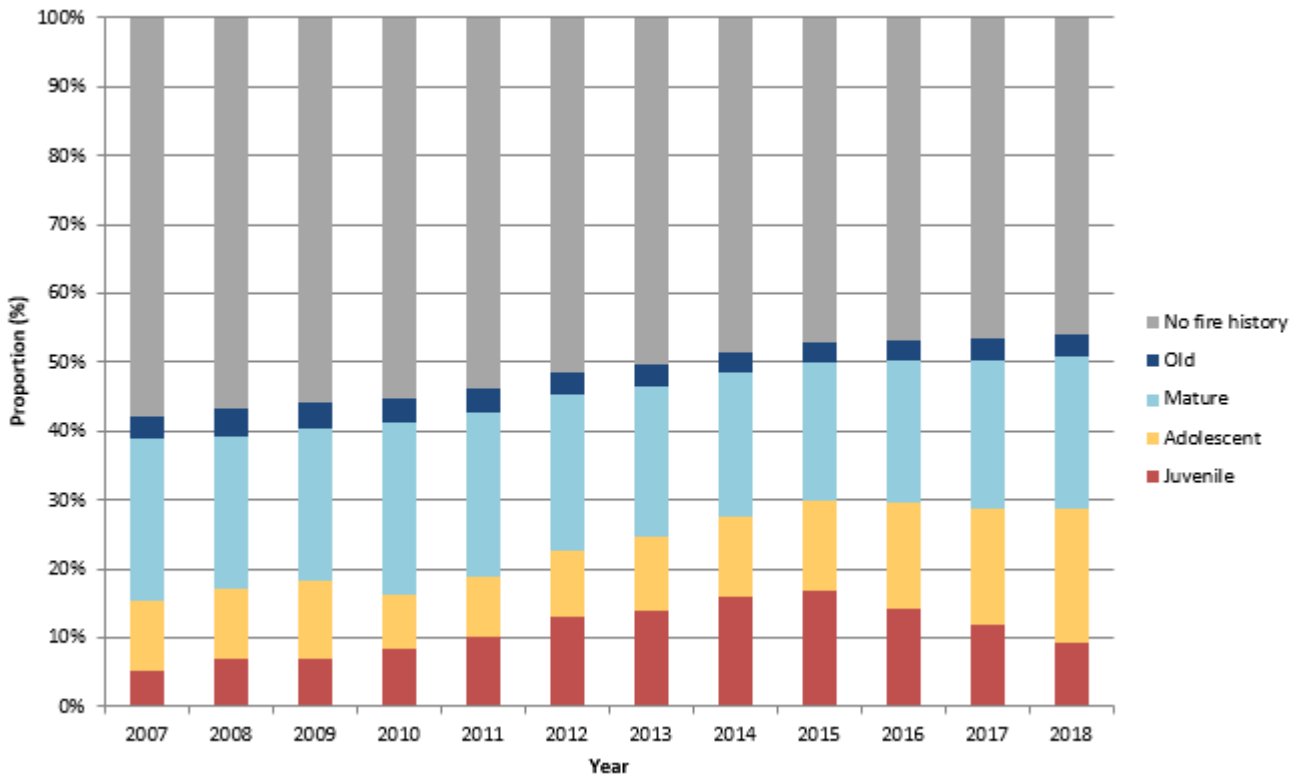
Figure 28: GSS status of public land vegetation, West Central BRL, 2007–18

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.

Fuel management activities

Statewide fuel management activities

Fire operations planning

Between June and August 2017, annual updates occurred to the 3-Year Fire Operations Plan (FOP). This plan was updated for the 2017 to 2020 period and the Chief Fire Officer approved it on 10 November 2017. It can be found on the Approved fire operations plan webpage. It includes all planned fuel management activities for the period of 2017 to 2020. This includes planned burning, slashing, mowing and clearing works, creating and maintaining fuel breaks and carrying out fire infrastructure maintenance, like fire dams and lookout towers.

The 2018 to 2021 FOP is currently being updated and is due for approval in November 2018. The Approved fire operations plan webpage will be updated once it has been approved.

From the end of 2018, FFMVic and CFA will jointly manage operations under a Joint Fire Management Plan (JFMP) – covering all activity across both private and public land.

Planning preparation and delivery of fuel reduction activities to keep Bushfire Risk below 70%.

Planned burning is a highly specialised activity, which can only be carried out when weather and fuel conditions allow it to be undertaken safely. 2017 was Victoria's sixth-warmest year on record and came with lower than average rainfall followed by a dry start to 2018.

Autumn 2018 was a challenging season for planned burning due to very dry conditions, accompanied by periods of high fire danger into April. Planned burning started later than normal, and opportunities were limited due to poor weather conditions. We selected areas of highest priority, where we would achieve the greatest risk reduction in areas where we had the right conditions.

The planned burn season did not continue much longer than normal, as the natural cooling, reduced drying and lower solar incidence, meant any moisture and rainfall had significant impacts on available fuels through May.

The underlying dryness did provide opportunities to undertake planned burns in damper forest types, which usually remain wet after the autumn break.

The season was ultimately characterised as challenging, limited, and interspersed with high fire risk periods. Despite this, bushfire risk was maintained below the 70% state target by prioritising burns that delivered the best risk reductions.

Below is a breakdown of the activities undertaken to keep bushfire risk below 70% for Victoria.

Table 1: Burn planning, site preparation and fuel reduction activities delivered for Bushfire Risk outcome of 66%, Victoria, 2017-18

Measurement	Outcome
Residual Risk Target for Victoria at all times	70%
Residual Risk for Victoria in 2017-2018	66%
Burn planning and site preparation	
Approved burn plan area (hectares)	248,427 ha
Planned burn field site preparation completed (hectares)	274,829 ha
Hazardous Trees Removed (kilometres of roadside treated)	709 km
Fuel reduction	

Area treated by planned burning:
    ecological burns 2,291 ha (34 burns)
    fuel-reduction burns 61,525 ha (201 burns)
    other burns (regeneration or catchment protection) 2,218 ha (132 burns)
	66,034 ha

Area treated by other fuel management methods	9,790 ha
Total area of fuel management towards residual risk target	**75,824 ha**

Table 2:Cross tenure planned burns 2017-18*

Region	Number of burns	Area (ha)
Barwon South West	5	241
Gippsland	3	5,662
Grampians	3	2,444
Hume	9	7,616
Loddon Mallee	0	0
Port Phillip	9	394
Total	**29**	**16,356**

* These planned burns are partially or wholly on private property within 1.5km of public land

Planned burn breaches

- A planned burn breach is considered to have gone beyond control lines if it spreads beyond the area designated in the burn plan. It 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.

French Island – Cemetery, 5 km east north east of Tankerton

Planned burn size 47 ha

Area of breach 12 ha

An ecological burn in a Land Management Zone on French Island National Park was ignited on 9 May 2017 and breached control lines the same day. The fire behaviour in the burn led to spot overs occurring outside the control line in an adjacent contingency area on public land. We could not readily suppress these spot overs due to safety concerns and therefore activated the contingency plan. This included conducting suppression at a fall-back line by using direct attack on any spot overs into the adjoining grassed areas. This resulted in about 12 ha of forested land in the contingency area and 0.48 ha of grassland on private land being burnt.

Bushfire response

In 2017-18 season, we attended 1,603 bushfires, totalling about 64,000 ha, on both private and public land. Three large fires in March, driven by strong winds, burnt grazing land, destroying 26 structures, 10,000 tonnes of hay and over 2,000 km of fencing. About 3,000 animals – mainly sheep and dairy cattle – died.

The season began very early in September with an 8,000 ha fire at Timbarra, Gippsland. The three largest bushfires all occurred in Gippsland where drought conditions in East Gippsland caused much higher than normal spread risk. They were:

- Tamboritha – Dingo Hill Track 10,839 ha
- Cann River – Mueller's Track 9,747 ha
- Timbarra – Sunny Point 8,120 ha.

The Tamboritha fire was started by an escaped campfire but was managed within a fuel reduction burn planned for autumn and a good result was achieved. Need to include how the other two started otherwise looks inconsistent just having one cause listed.

During the year, Victorian firefighters were deployed to support firefighters in Canada, the United States of America, and South Australia, all of which had challenging fire seasons. Firefighters from New South Wales and South Australia helped respond to Victorian bushfires.

Regional fuel management activities

Barwon Southwest

Table 3. Fuel reduction, Barwon South West region, 2017-18

Fuel reduction	Ha
Area treated by planned burning: <u>ecological burns</u> 4 ha (1 burn) <u>fuel-reduction burns</u> 1,323 ha (24 burns) <u>other burns</u> < 1 ha (1 burn)	1,328
Area treated by other fuel management methods	1,005
Total area of fuel management towards risk reduction target	**2,333**

Gippsland

Table 4: Fuel reduction, Gippsland region, 2017-18

Fuel reduction	Ha
Area treated by planned burning: <u>ecological burns</u> 803 ha (10 burns) <u>fuel-reduction burns</u> 7,764 ha (24 burns) <u>other burns</u> 1,297 ha (67 burns)	9.865
Area treated by other fuel management methods	1,641
Total area of fuel management towards risk reduction target	**11,506**

Grampians

Table 5: Fuel reduction, Grampians region, 2017-18

Fuel reduction	Ha
Area treated by planned burning: <u>ecological burns</u> 1,240 ha (6 burns) <u>fuel-reduction burns</u> 8,737 ha (40 burns) <u>other burns</u> < 1 ha (3 burns)	9,978
Area treated by other fuel management methods	2,355
Total area of fuel management towards risk reduction target	**12,333**

Hume

Table 6: Fuel reduction, Hume region, 2017-18

Fuel reduction	Ha
Area treated by planned burning: <u>ecological burns</u> 101 ha (4 burns) <u>fuel-reduction burns</u> 32,633 ha (54 burns) <u>other burns</u> 829 ha (43 burns)	33,564
Area treated by other fuel management methods	988
Total area of fuel management towards risk reduction target	**34,552**

Loddon Mallee

Table 7: Fuel reduction, Loddon Mallee region, 2017-18

Fuel reduction	Ha
Area treated by planned burning: <u>ecological burns</u> 26 ha (7 burns) <u>fuel-reduction burns</u> 7,040 ha (40 burns) <u>other burns</u> < 1 ha (3 burns)	7.067
Area treated by other fuel management methods	2,593
Total area of fuel management towards risk reduction target	**9,660**

Port Phillip

Table 8. Fuel reduction, Port Phillip region, 2017-18

Fuel reduction	Ha
Area treated by planned burning: <u>ecological burns</u> 114 ha (6 burns) <u>fuel-reduction burns</u> 4,025 ha (19 burns) <u>other burns</u> 90 ha (4 burns)	4,230
Area treated by other fuel management methods	1,208
Total area of fuel management towards risk reduction target	**5,438**

Costs

Statewide and regional fuel management costs

The cost of the entire fuel management program in 2017-18 was $107.8 million. Of this, direct fuel management costs were $30.4 million and indirect fuel management costs were $77.4 million. Other (non-fuel-management, not shown in table) activities including fire and emergency response, recovery, prevention and preparedness activities cost $190.2 million.

Table 9: Fuel Management costs, by region and group 2017-18

Region	Fuel management (direct	Fuel management (indirect)	Total
Barwon South West	4,147,256	5,353,634	9,500,890
Gippsland	3,369,488	11,216,814	14,586,302
Grampians	4,668,716	5,569,878	10,238,594
Hume	7,520,727	11,371,691	18,892,418
Loddon Mallee	3,195,092	5,652,438	8,847,530
Port Phillip	3,521,813	3,441,254	6,963,067
Forest & Fire Operations Directorate	33,332	6,968,351	7,001,683
Total Forest & Fire Operations Division	**26,456,424**	**49,574,060**	**76,030,484**
Infrastructure & Resources Division (IRD)	3,939,852	21,227,291	25,167,143
Policy & Planning Division (PPD)	0	6,591,696	6,591,696
Total IRD & PPD	**3,939,852**	**27,818,987**	**31,758,839**
Total fuel management costs	**30,396,276**	**77,393,047**	**107,789,323**

Infrastructure investment

- Investing in infrastructure upgrades is an important part of reducing the risk of bushfires to life and property.

- Over the next three years $273.3 million is being invested to upgrade roads, bridges and fire towers. This is part of our risk reduction program.

Victorian bushfire monitoring program

Statewide monitoring activities

The Victorian Bushfire Monitoring Program (VBPM) activities focus on implementing the *Monitoring Evaluation and Reporting Framework for Bushfire Management on Public Land*.

Collecting information about fuel hazard enables us to monitor the effectiveness of planned burns at reducing fuel hazard and evaluate progress towards reducing bushfire risk.

Fuel hazard data and information was collected at 2,992 sites covering 20% of all planned burn operations across the state. We use this information to improve strategic fuel management and enable us to deliver on our commitment to transparent evaluation of the effectiveness of our risk reduction activities.

In 2017-2018, the VBMP commenced with the roll-out of the ecosystem resilience monitoring program. This included:

• Development an extensive historical fire-biodiversity monitoring programs database which enables storage of newly collected monitoring data.

• Piloting the scientifically-based Ecosystem Resilience Monitoring Program at 106 sites in central-western Victoria. This program intensively samples plants and animals at strategic locations to collect data that will enable us to develop fire management scenarios that best support the environment.

• Over the coming 6 years, the full program will deliver 2200 monitoring sites across the state and will be the world's most advanced and comprehensive integrated adaptive management program for evaluating the effects of fire management on ecosystems and directing improvements.

• This work will allow us to deliver on our objective to maintain and improve the resilience of Victorian ecosystems.

•

Monitoring type	Region Season	Barwon South West Autumn	Spring	Gippsland Autumn	Spring	Grampians Autumn	Spring	Hume Autumn	Spring	Loddon Mallee Autumn	Spring	Port Phillip Autumn	Spring	Statewide total
Fuel Hazard monitoring	Pre-burn	128	0	118	0	218	0	113	0	177	30	155	0	1,487
	Post-burn	71	39	17	0	67	0	157	0	49	30	118	0	
	Validation	0	68	0	0	1,200	0	0	0	0	3	0	234	1,505
Ecosystem resilience monitoring		32		53		6		10		627		4		732
Total (by region)		338		188		1,491		280		916		511		3,724

Regional monitoring activities

Barwon Southwest

In 2017–18, we continued to implement our monitoring, evaluation and reporting plan. We focused on monitoring overall fuel hazard, monitoring programs to improve the risk models we use to inform strategic planning, and monitoring fire severity; and we expanded our ecosystem resilience monitoring program. We also 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) monitoring across 14 burns, with 128 sites monitored pre-burn and 110 sites monitored post-burn.

We continued our monitoring project collecting data on fuel accumulation in the Wye River –Jamieson Track fire area and the nearby Wye River – Kennett Wye Jeep Track burn area. This project is validating the fuel accumulation curves we use as part of modelling risk. We monitored 68 sites for OFH and vegetation structure, and we got comprehensive imagery of the sites.

We did our annual fire-severity mapping in 2017–18 at 21 forested burns. An app-based tool using Collector for ArcGIS has been developed locally, and we are trialling it to enable in-field editing of the desktop analysis, to help make fire-severity mapping more streamlined and accurate.

Two training events about OFH monitoring were conducted in the region, and 11 additional staff were trained in the Otway district (including two Country Fire Authority staff) and 14 staff in the Far South West district.

Several trials started in the Far South West district, to better inform management actions to control woody weeds. This involved contractors assessing sites to look at habitat / structural attributed before treatment and the effectiveness of different treatment options. These trials will continue over the next few years.

In the period 2012–17 in the Otway Ranges, we partnered with the University of Melbourne and the Fire, Landscape Pattern and Biodiversity and Hawkeye Projects. These projects enable us to better understand how more planned burning might affect species by assessing their responses to fire disturbance. Data analysis from recent re-sampling is underway and preliminary findings help us better understand the preferences of small mammals, fox predation and the benefits of maintaining a mosaic of age classes within the landscape.

The Anglesea – Bald Hills burn to the north-west of Anglesea allowed us to trial fine-scale, unbounded burning in a large area of heathy woodland, and we will monitor it for its effects on fuel hazard and ecosystem resilience. We completed camera, habitat structure and fuel hazard assessments to collect data before the burn, before we proceeded with this alternative way of burning. We will follow this with post-burn monitoring, expanded as the burn progresses, to better understand the ecological and fuel-management benefits of fine-scale mosaic burning in heath.

The University of Melbourne partnered with us in our Fire, Landscape Pattern and Biodiversity Project and Fire and Fragmentation Project. These are detailed studies of ecosystem responses to fire, which will inform our fuel-management planning. We complement these projects with in-house monitoring to address planning questions (such as what effect fire frequency as on threatened species of small mammals, and what effect canopy scorch has on Red-tailed black cockatoo feeding habitat).

La Trobe University worked with us on a statewide pilot project to identify a decision-making process to monitor effort investment, helping with survey design. The pilot re-sampled existing Otway Hawkeye sites to improve our knowledge of the response of small-mammal species to fire frequency.

We collaborated with Deakin University on studies in the Anglesea Heath. Deakin are investigating manufactured refuge tunnels that native wildlife can use after a fire when returning to burnt areas, and they drew on our monitoring data to decide where to place the tunnels.

Gippsland

Our priorities in the second year of implementing our monitoring, evaluation and reporting plan were to monitor the reduction of risk to life and property through overall fuel hazard (OFH) assessments and fire-severity mapping and to continue developing the ecosystem resilience monitoring program.

Staff from all four districts — Snowy, Tambo, La Trobe and Macalister — were involved in monitoring activities including more OFH assessments. We continued developing the ecosystem resilience monitoring program, initiating new projects to investigate the fire management needs of various animal and plant species.

During the year, we continued to invest in OFH assessment as part of our pre- and post-burn monitoring in autumn 2018. Gippsland monitored 11 burns and did pre-burn assessments of 135 sites. Across the four districts, we conducted OFH assessments at four planned burns at 60 sites.

We completed a several fire-severity mapping projects across Gippsland. These included:

• Port Phillip district coordinated with Gippsland district to deliver aerial imagery of burns, resulting in images across a combined total of 5,315 hectares and 11 burns covering three regions — Port Phillip, Gippsland and Hume — and four fire districts — Yarra, Metropolitan, Latrobe and Murrindindi

• capturing aerial imagery of about 20,500 ha in Port Phillip to map and digitise the fire severity of 17 burns including: three burns over 12,425 ha in the Snowy district, seven burns over 1,445 ha in the Tambo district and seven burns over about 2,000 ha in the Macalister district.

• Latrobe district burns, which were captured by Port Phillip district this year as per contract arrangements.

• on-ground mapping of fire severity across five smaller burns, mostly in Macalister district.

We conducted a pre- and post-burn monitoring project of the New Holland mouse, to inform fire management practices in suitable habitat. This project collected information about two separate populations of the mouse, at Gippsland Lakes Coastal Park and Providence Ponds. The project is running parallel to two other projects collecting information about the New Holland mouse: a PhD project and our fox-baiting program. The program is continuing in 2018–19.

We did fieldwork from November 2017 to January 2018 on our *Banksia canei* project. Contractors did the fieldwork and the report, which is due shortly, was written by the Arthur Rylah Institute. The project aims to better understand key attributes of the species, compare the attribute information to fire management zoning and the species' tolerable fire interval and assess the risk to the species of the current management regime. The program is continuing in 2018–19.

We undertook mitigation checks of the implementation and effectiveness of mitigation measures through the fire operations planning process, initially for biodiversity values and cultural values. We began to develop a process to shift from a desktop process to a field-based process. The program is continuing in 2018–19.

Grampians

Our monitoring, evaluation and reporting program priorities in 2017–18 were monitoring to determine how effectively fuel-management activities reduce risk to life and property and expanding our environmental monitoring program.

We conducted fire-severity mapping for all planned burns over 5 ha, and we used the data to update our fire history mapping. It enables us to model changes in fuel loads across the landscape and determine effects on ecosystem health.

We took a total of 285 overall fuel hazard (OFH) assessments before and after planned burns to assess their effectiveness in reducing fuel hazard. We monitored a total of 26 burns.

We assessed 1,200 sites for OFH as part of a pilot project which aims to assess the best method for improving the fuel accumulation models used in Phoenix Rapidfire. The fuel type being assessed in the pilot study is forest with shrub. This fuel type is found around Daylesford, Hepburn and Ararat — all high-risk locations — and current modelling does not appear to accurately reflect fuels that remain after a fire. We are currently analysing the data.

We started a program to assess the effects of planned burns on Brush-tailed phascogales in the Hepburn–Daylesford area. We mapped tree hollows and used camera traps to determine the presence of phascogales before and after the burn. We intend to expand this program, to assess the effects of planned burns on Greater gliders. We are also working with the Barwon South West region to develop species response curves for flora and fauna in the fire-dependent northern range of the Red-tailed black cockatoo.

During the year, we also assessed and reported on canopy scorch in planned burns in Red-tailed black cockatoo habitat in the Wimmera district. We collated this figure with figures from the Far South West district to get an overall scorch figure for Red-tailed black cockatoo habitat on public land in Victoria.

Hume

In 2017–18, we continued implementing our monitoring, evaluation and reporting program. We continued our focus on monitoring overall fuel hazard (OFH) and severity, and we expanded our ecosystem resilience monitoring program.

During the year, our OFH and fire-severity monitoring activities included:

- 234 pre-burn OFH assessments across 15 burns, about half of which were rolled over from the previous year

- monitoring of 15 burns, 14 of which were ignited in autumn

- 178 post-burn OFH and severity assessments across the 14 ignited burns, of which 115 plots had evidence of fire

- severity mapping for the 14 burns, with aerial imagery used for burns greater than 500 ha.

We held two training sessions in the Ovens district, to improve the capacity of staff and maintain their skills in OFH data collection and technologies.

We completed pre- and post-burn OFH assessments for one cross-tenure burn in the Hume region, with 23 pre- and post-burn OFH and severity plots assessed.

During the year, we completed the first full year of the Greater Glider Ecological Resilience Project, monitoring five sites in the Strathbogie Ranges for the glider. The project's findings will be shared after an interim report by Arthur Rylah Institute subject-matter experts, due in October 2018, is completed. The interim report will inform future monitoring and management practices. A final report is due in 2019.

The Hume Forest and Fire Planning team, together with the Natural Environment team, hosted the Fire Ecology Forum. Staff of Forest Fire Management Victoria, the Country Fire Authority and local governments, and researchers, came from across the state to discuss fire ecology projects. They heard reports about the state and Hume region monitoring, evaluation and reporting programs and the Greater glider project, and about research into ecological resilience and flora fire tolerance. The forum was a good opportunity for districts staff to link research findings to their operational practices, to improve biodiversity outcomes.

The Hume Forest and Fire Planning team worked with Parks Victoria to develop the River Redgum Mitigation Project in Barmah National Park in the Goulburn district. The project will be delivered in 2018–19, and its findings will inform management of cultural values and mitigation measures to protect significant river redgum trees from fire.

During the year, we worked to expand the strategic bushfire risk analysis to include biodiversity values for the Hume region (such as the Greater glider and the Broad-toothed rat). This will inform ecological risk analysis for strategic bushfire management planning in fire management zones.

Loddon Mallee

In 2017–18, we continued to implement the landscape's monitoring, evaluation and reporting program, with a focus on monitoring changes in fuel after planned burns in high-priority areas. We also expanded the program to monitor the effects of fuel management on biodiversity.

During the year, we conducted pre-burn monitoring and overall fuel hazard (OFH) assessments of 18 planned burns at 207 plots: 10 burns in the Mallee district and eight in the Murray Goldfields district. We conducted post-burn OFH monitoring on all eight completed burns, at 79 plots: two burns in Mallee and six in Murray Goldfields. We postponed the remaining 10 burns — eight in Mallee and two in Murray Goldfields — due to unsuitable conditions.

Mallee district undertook fire-severity mapping, to map and digitise the fire severity of 14 burns planned for 7,406 ha and 13 burns conducted, over 4,537 ha. Murray Goldfields district captured aerial imagery to map and digitise the fire severity of 12 burns over 2,340 ha: four burns in spring over 636 ha and eight burns in autumn over 1,704 ha. On-ground fire-severity mapping was also completed for seven spring burns and five autumn burns.

In March 2018, we delivered field training in the use of the ArcCollector app to 18 Mallee district staff, providing them with the skills to do OFH assessments.

RMIT Remote Area Fuels Remotely Project

A key risk mitigation strategy in the Mallee district is to develop unbounded strategic breaks —burns without tracked edges — across the Little Desert, Big Desert Wyperfeld and Murray Sunset national parks. These strategic breaks are very remote, often have little or no edge contact with a formed track and range up to 25 km into the untracked wilderness areas of these large blocks of public land. It is important that we know how effectively unbounded strategic breaks moderate bushfires, especially when resource limitations prevent us directly attacking all fires started by lightning strikes in remote locations.

The project aimed as to identify a cost-effective method to accurately assess OFH in remote areas by:

• developing a sensor method to capture imagery data for assessing OFH across these large, remote areas from either an un-crewed fixed-wing aircraft or helicopter, or a crewed aircraft

• developing algorithms to interpret imagery data into a quantitative OFH assessment that is comparable with the metrics used statewide through the application of the *Overall Fuel Hazard Guide*.

The project demonstrated proof-of-concept for several remote-sensing platforms, but more work is needed to improve its feasibility for the vast Mallee landscape.

Big Desert – Wyperfeld Pitfall Project

This project will improve our ability to investigate the effects of fire on fauna and help us develop more-robust fire-response models for mammals and reptiles in the Big Desert Wilderness Park and the Wyperfield National Park. In late 2017, 125 pitfall traps were established in the two parks, to prepare for survey work in late 2018.

Box Ironbark Environmental Mosaic Burn Project – Floristics assessment

In 2017–18, we engaged consultants to undertake repeat vascular plant surveys in the 600 quadrats in 15 areas — six for autumn burns, six for spring burns and three for reference — established for this project. This will provide another data point for post-fire comparisons of vegetation and flora recovery rates. Raw field survey data has been provided to us in digital format, but we have not yet analysed it.

Box Ironbark Environmental Mosaic Burn Project – Habitat structural assessment

As with the floristic surveys, the purpose of this project is to provide additional data for post-fire comparisons of vegetation and flora recovery rates. During the year, repeat habitat structural and tree measurement surveys were undertaken across 251 plots. This data will be analysed in 2018–19.

Fire ecology and management of the endangered Mallee emu-wren

The Mallee emu-wren *Stipiturus mallee* has had a major population contraction, which has resulted in the global population being largely restricted to one reserve complex in the Mallee. The key threat to this species is fire, and appropriate fire management is essential to reduce the extinction risk to this species and to promote its recovery. Fire management for this species requires detailed knowledge of the effects of fire and fire management activities on it.

This project, conducted in partnership with La Trobe University, identified the critical habitat driver for the species and demonstrated contrasting successional patterns of habitat features and the species at different elevations. It provided a greatly improved map of the species' distribution and has identified parts of the landscape and localised spots that can support high densities of the species.

New fire-response models produced as part of the project show that:

• the fire response of porcupine grass (*Triodia scariosa*) is different depending on the topographic position (as represented by elevation)

• *Triodia* responses are also reflected in elevational differences in the fire responses of the Mallee emu-wren

• the best Mallee emu-wren habitat is in the low-lying, sandy areas of Hattah-Kulkyne National Park

• the scattered nature of the small pockets of best Mallee emu-wren habitat throughout the park makes it difficult to use strategic fire breaks effectively, without negative effects.

This project is a major step forward in understanding and managing successional changes in Mallee ecosystems, and it has identified fire management actions to protect Mallee emu-wren populations from the effects of bushfire.

Port Phillip

2017–18 was the third year of implementing our monitoring, evaluation and reporting plan.

During the year, we used fire-severity mapping to update our fire history layers, to inform ecological modelling and our understanding of fire behaviour. Fire-severity mapping activities included:

- capturing aerial imagery of 3,694 ha for five burns: three in Yarra district over 3,577 ha and two in Metropolitan district over 117 ha

- on-ground mapping

- coordination with Gippsland region to capture aerial imagery of burns, resulting in images of 11 burns over a total 5,315 ha in three regions — Port Phillip, Gippsland and Hume —and four fire districts — Yarra, Metropolitan, Latrobe and Murrindindi.

To assess overall fuel hazard (OFH) as part of pre- and post-burn monitoring in autumn 2017, we monitored 14 burns at 245 sites.

Collaborating with Federation University, we completed a research project that saw an industry-based-placement student investigate over six months the link between fire severity and OFH after planned burning in the Port Phillip and Gippsland regions.

We held four training workshops to build capacity and skills to conduct OFH assessments with the Fuel Hazard Collector app, assess fire severity, do digital mapping of burns using aerial imagery and use ArcMap and mapping software programs. The training was for our staff, partner agencies and CSIRO.

The Port Phillip Forest and Fire Planning team hosted a science and planning forum for over 70 staff from Forest Fire Management Victoria, local governments and research organisations to learn about fire ecology projects and biodiversity across three regions and four fire districts.

We supported the implementation of an Arthur Rylah Institute project to monitor the effects of fire severity on the recruitment of Hairpin banksia. This followed on from previous work to better understand the species' seed production and seedling recruitment, which will improve our understanding of optimal fire intervals.

The findings of ecosystem resilience projects involving Smoky mouse and a small-mammal pilot study contributed to a research project with La Trobe University. The final report, published in May 2018, made recommendations about monitoring ecosystem resilience across the state and in regions.

During the year, we expanded the strategic bushfire risk analysis for the Leadbeater's possum, identifying areas suitable for planned burning that would reduce the bushfire risk to the possum and its habitat.

Topics of interest

Safer Together

Bushfires are a part of life in Victoria – but together, we can reduce their impact and build safer communities, a thriving economy and a healthy environment. Safer Together is Victoria's approach to reducing the risks of bushfire. It focuses on how effective our actions are in reducing risk, not just the amount of activity we undertake.

Safer Together means a more integrated approach across public and private land, with fuel management just one of the different management actions we will take to protect lives, homes, jobs and the environment. There are four major themes under Safer Together:

• **Community First**: We involve local communities in decision making about bushfire management all year round – this means understanding what they care about most and working with them to determine local solutions to reduce bushfire risk

• **Working Together**: We plan and deliver bushfire management across public and private land. Risk reduction will drive all our activities from planned burning to fire response

• **Science and Technology**: We continue to investment in science, and partnerships with research institutions, to build knowledge of the relationship between fire and the environment and to better manage risk.

• **Understanding Risk:** Bushfires impact the things we care about - our communities, our homes, our businesses, liveability and our environment. We can better reduce these impacts by understanding where and how bushfires spread, how they impact communities and the environment, and measuring how effective our actions are in reducing these impacts.

Consistent with the 'working together' theme, Forest Fire Management Victoria, Country Fire Authority, Emergency Management Victoria and local governments work in partnership to deliver *Safer Together*.

Safer Together is part of how we are implementing the recommendations of the Inspector-General for Emergency Management's 2015 *Review of performance targets for bushfire management on public land*. This included moving from a hectare-based target for fuel management activities to a risk-reduction target, which we did in 2016–17. Safer Together is being implemented through 16 enabling projects.

Community first

This is about working with local communities to understand what risk means for them, the things they value and how communities and fire and emergency management agencies can work together to create safer, more resilient communities and ecosystems.

A big focus in this area is the community-based bushfire management (CBBM) we are implementing. This brings together community members, agencies and local government to share their knowledge about bushfire risk management. Community-based bushfire management provides the opportunity for communities to be more actively involved in bushfire management planning and decision making and to shape local and specific ways to reduce bushfire risk. There are now 18 active CBBM communities: Benloch, Strathbogies, Mallacoota/Buchan, Wye River, Lorne, St Andrews, Harrietville, Healesville, Macedon Corridor, Daylesford/Hepburn Springs, Latrobe Valley, Yellingbo, Clonbinane, Briagolong, Timboon/Peterborough, Airey's Inlet, Balmoral, Bolwarra Complex (Bolwarra, Gorea, Gorea West, Heathmere). A further 5 communities will be established in 2018–19.

Another Community First project is building the awareness, skills and capabilities of firefighters, volunteers and fire managers to engage with local communities. A third project is helping communities understand and manage their bushfire risk, including by writing bushfire plans, preparing their properties and joining fire learning networks.

Working together

Through *Safer Together*, land and fire agencies are working more closely than ever to plan and undertake bushfire management activities across both public and private land including:

• bushfire planning and response

• planning, preparing for and conducting planned burns

• resource allocation

• risk assessment, and

• staff and volunteer training.

This makes bushfire management more-informed and better-resourced, and there is a consistent approach by all the agencies communities turn to for protection from bushfire risk. It also gives communities and Traditional Owner groups clearer, more direct access to the fire management sector.

There are 10 projects underway focusing on improving the sector's preparedness and response to bushfires on public and private land:

• Common burn risk assessment tool

• Common quality assurance system for fuel management

• Cultural burning practices

• Expanding strategic bushfire management planning

• Joint delivery

• Joint planning

• Joint training system in relation to planned burning

• Safer Together policy and legislative enablers

• Shared doctrine framework.

Two workshops were held in pilot areas, Loddon Mallee (15 multi agency participants) and Gippsland (11 multi agency participants). The intent of the workshops was to review the current Strategic Bushfire Management Plan (SBMP) process and select areas of the Technical Methods Reference Document and look for ways to incorporate an all tenure approach to first attack suppression and prevention of human caused ignitions. The workshop highlighted positives and areas for improvement. The recommendations from the review workshops will be incorporated into future planning for the project.

Science and technology

There are four key science and technology research themes under Safer Together:

• effective operations

• fire science

• understanding our community

• understanding our environments

We currently partner with major Australian universities, iconic Australian research institutions (including CSIRO and the Bureau of Meteorology) and other organisations to run 11 research projects under these research themes.

• Application of self-evacuation archetypes.

• Behavioural insights into Fire Danger Ratings and warnings.

• Creation of Grass Fire Danger Index dataset.

• Cropland fire behaviour research.

• Development of season fire prediction tools.

• Effectiveness of resources to suppress bushfire: Aerial and ground based.

• Fire and biodiversity – impacts, recovery and future planning: vegetation responses to planned fire.

• Identifying planned burning windows.

• Understanding the impacts of climate change on fire weather variables.

• User interface platform for the Victorian historical fire weather gridded dataset.

• Relationship between soil and fuel drying – flammability switch.

This *Safer Together* theme includes a project to develop a monitoring, evaluation and reporting framework to measure and report on our success in reducing bushfire risk to people, property and the environment in a multi-agency context.

DELWP will lead and deliver on behalf of the emergency management (EM) sector a common *Safer Together* Monitoring, Evaluation and Reporting Framework (ST MERF) and systems that enable partner agencies under the *Safer Together* policy to efficiently manage strategies performance and effectively improve current systems and processes.

The *Safer Together* Monitoring, Evaluation and Reporting Framework will:

• Measure the implementation and effectiveness of *Safer Together*

• Consolidate existing and proposed MER across the EM sector and align efforts for a sector wide MER process.

• Identify the baseline data required to understand our current state and progress towards the *Safer Together* outcomes

• Provide accountability for and transparency of sector wide actions toward delivering *Safer Together*.

The framework is currently under development with multiagency workshops to ensure cross agency suitability and relevance.

Through the application of new science, data and research, the stream will also deliver a bushfire science strategy to guide our research priorities and investments and to improve the Phoenix Rapidfire modelling software and the Victorian Fire Risk Register and tools for use in planning and community engagement. We use this to target our actions to where the risk is and ensure actions are appropriate for the local environment.

Smoke

- When we carry out planned burns, we work with the Department of Health and Human Services and Environment Protection Authority to minimise smoke impacts on communities. While these impacts can never be entirely avoided, a balance is sought between managing smoke and reducing the risk of major bushfires.

- We have invested in new technologies to predict the spread and dispersal of smoke from planned burns, and better manage smoke impacts on communities, infrastructure and the environment.

    − The Air Quality Forecast System (AQFx) forecasts the concentration and distribution of smoke and pollutants. The AQFx was developed through collaboration between DELWP, CSIRO Oceans and Atmosphere, Bureau of Meteorology and the University of Tasmania.

    − Further research by CSIRO and University of Tasmania has led to the development of the Air Quality Visualisation system (AQVx) which incorporates satellite and crowd sourced data to provide real time smoke event monitoring intelligence.

- We have partnered with CSIRO and the Department of Education to rollout a schools Science Technology Engineer and Math (STEM) project which places smoke monitors in schools and teaches children about sensor technology and environmental data collection.

Working with community: Community-based bushfire management

Community-based bushfire management (CBBM) brings together members of the public, state government agencies and local governments to discuss bushfire risk. It's giving the community input into how fire is managed in the landscape. It's a partnership approach to bushfire management that gives people in the community an equal voice. Instead of starting with what's important to the government, the starting point is what's important to the community.

'There's a shift that occurs when you allow space for others to have a say.'

Watch the CBBM overview video.

'The make-up of the group is really interesting. At the start, some of the relationships were really tense. Now, people are talking to each other. It's brought people together into the same room, having civilised conversations. It doesn't mean people always agree, but there's a lot more respect and understanding.'

Watch the Strathbogies CBBM video.

'We might say with community-based bushfire management that the entry point into that conversation is bushfire, but I think bushfire is just a gateway to an effective conversation about building resilience.'

Watch the Wye River CBBM video.

There are now 18 active CBBM communities: Benloch, Strathbogies, Mallacoota/Buchan, Wye River, Lorne, St Andrews, Harrietville, Healesville, Macedon Corridor, Daylesford/Hepburn Springs, Latrobe Valley, Yellingbo, Clonbinane, Briagolong, Timboon/Peterborough, Airey's Inlet, Balmoral, Bolwarra Complex (Bolwarra, Gorea, Gorea West, Heathmere). A further five communities will be established in 2018–19.

In 2018–19 the CBBM team will grow to eight, with three FFMVic-based project officers in the Port Philip, Barwon South West and Gippsland regions, and five CFA-based project officers.

Choosing the right burns at the right time

Planned burning can only occur when the conditions are right, and it is safe to ignite and manage a burn. The right conditions usually arise in Autumn, which is when we carry out most of its planned burns. This is because the weather is more stable in Autumn and we get ideal conditions —sunny days, light winds, cool nights and overnight dews — for planned burning.

Combined with the right fuel moisture – which is in the 12–16% range – these short windows of opportunity allow us to safely ignite and manage the burns.

However, some types of vegetation require different conditions for a burn to go ahead. We can ignite some types of vegetation at any time, even in winter, but some types of vegetation in certain areas have a very small window of opportunity when conditions are right – this is often only a few days each Autumn.

For example, fuel conditions quickly go from too dry to too wet in the Otway forests, in the Dandenong Ranges and in Wombat Forest near Daylesford.

We call periods of the year where the weather and vegetation conditions are right for planned burning 'peak burn windows'. Some windows are only one or two days a year, some are seven days in a season, while some locations have no major timing constraints.

Maximising the outcomes of each burn is our top priority. That means prioritising burns that will result in the greatest reduction of risk to life and property from a major bushfire, and also prioritising burns that are important for other reasons such as burns that reduce local risk or maintain or improve forest and ecosystem health.

Our staff travel widely across the state during a peak burn window to maximise opportunities to carry out fuel management. When several regions have peak burn windows at the same time, our staff and equipment can become stretched to the maximum, and we have to decide where to allocate resources. We choose areas of highest priority, where will achieve the greatest risk reduction under the right conditions.

We use computer simulations to identify which of the burns planned across Victoria each year will result in the biggest risk reduction. However, the need to reconcile risk-reduction priorities with the other factors — weather conditions, vegetation type, the size of peak burn windows, local priorities and organising and moving resources — calls for ever-increasingly sophisticated modelling and decision support.

Accordingly, we have developed and last year implemented for the first time our new planned burn optimisation tool. This decision support tool enables us to consider all factors simultaneously to determine which burns we should do next —burns that offer high risk-reduction and address local priorities but only have very narrow window of opportunity. The tool was co-created by our fuel management experts and risk analysts to create an efficient way of analysing and displaying data to better support decision makers.

Not only does the tool improve our decision making about where to conduct planned burns and when, it also provides the evidence we can use to explain those decisions to staff and to communities who may be directly impacted by planned burns. It builds trust with communities, which is the foundation of our community-based bushfire management approach.

Last year, our staff in the regions used the tool for the first time to prioritise their program. It supported planning and resource allocation around the state.

The Planned Burn Optimisation Tool:

• Translates the three-year fire operations plan into a 12-month planned burning program.

• Gives each planned burn a 'Victorian burn effectiveness rating', showing how much it would reduce the state's bushfire risk.

• Gives each burn a regional rating, which takes account of the amount of local risk it reduces, its cultural and ecological priority, and its alignment to the regional strategic bushfire management plan.

• Determines which burns have very high importance, which have high importance, and which have standard delivery importance.

• Identifies the extent of the burn windows required for each high importance burn

This information enables us to be well prepared to conduct a planned burn should the right conditions present a window of opportunity.

Mulching

The Metropolitan Fire District in the Port Phillip region has many areas with houses at risk from bushfire because they are adjacent or close to public land, such as the Heathy Woodland reserve. To manage the bushfire risk to nearby houses, in the 1990s and 2000s we did regular fuel reduction burns in the reserve. However, after these burns, some shrub species rapidly grew back, creating a thick mid-storey across the burnt sites.

Staff in the Port Phillip region decided to try another approach to reducing bushfire risk in the Heathy Woodland reserve. In November 2015, we mulched about 11.6 ha of the reserve, leaving some areas unmulched. Two years on, the mulched sites have retained their overstory and there's been no significant regrowth of the mid-story shrubs, effectively reducing the risk on the site. Since 2015, we have trialled mulching in several other sites in the Metropolitan Fire District.

In early January 2018, a fire in the Heathy Woodland reserve travelled through both mulched and unmulched areas. Afterward, we examined the areas impacted by the fire to see the post-fire differences between the mulched and unmulched areas. We also interviewed the fire crews about the fire behaviour, and how they were able to suppress the fire and bring it under control.

From the examination of the burnt areas, it appears the fire in the mulched areas was less intense and severe than in the unmulched areas. The percentage of canopy burnt was three times less in the mulched areas of the reserve, suggesting that removing mid-storey vegetation in the mulched areas reduced the likelihood of the fire reaching and burning the canopy. This is likely to mean more of the canopy species will survive in coming years.

The interviews with fire crews determined that wind was a key factor in how the fire behaved. We use the Forest Fire Danger Index (FFDI) to measure the degree of danger of the fire, and on the day of the fire in Heathy Woodland reserve, the index suggested severe danger as a result of strong winds. It is difficult to reduce the severity of fires through suppression activities when the FFDI is in the severe range, so the evidence of reduced severity of the fire in the mulched areas was a positive outcome.

So, it is likely the mulching — specifically, removing the mid-storey shrubs — helped reduce the risk of bushfires, as well as the severity and intensity of fires if they occur. Had the wind not influenced the severe FFDI the mulching might have been even more effective at reducing the intensity and severity of the fire.

Cultural burning strategy

Up to 1788, and for a long time after, Aboriginal people across Australia used fire tools to manage landscapes. Recent environment history and ecological research suggests the decline in cultural burning after colonisation worsened ecosystem health in Victoria and increased bushfire risk.

Prohibiting the use of fire and limiting access to land have constrained the rights and obligations of Victoria's Traditional Owners to care for Country and pass on their knowledge of fire to the next generation. Consequently, Victorian Traditional Owners have made clear that the cultural use of fire needs to be reintroduced, adapted and applied in Victoria, to allow for healing and caring for Country.

Traditional fire practices were largely prohibited after European settlement, and Victoria's Traditional Owners haven't, until recently, been able to share their fire management knowledge, stories, language and practice.

Over time, that practice and knowledge has been fragmented and has effectively 'gone to sleep'. It lives on in the knowledge of elders, but they haven't been able to pass it on to the next generation through practice and storytelling.

In the last five years, many new local partnerships have formed between Traditional Owners and land management authorities including Forest Fire Management Victoria (FFMVic), CFA, catchment management

authorities and local governments. Through these partnerships, more and more is being learned about cultural burning in Victoria and traditional fire practice is being revitalised and rediscovered.

At the same time, Traditional Owners are starting to develop strategic planning documents (such as Country plans) that state their aspirations for how Country should be managed and the values for which it should be managed.

These local initiatives show the opportunities and challenges for Traditional Owners who are navigating the fire management sector in Victoria.

One challenge has been the lack of a clear approach or strategy across the main fire agencies to support Traditional Owners to undertake cultural burning for the range of cultural values associated with caring for Country. These values include producing food, game and material culture species, and for maintaining the collective wellbeing that arises from caring for Country.

To address this challenge and support an increase in cultural burning practice across Victoria, the Federation of Victorian Traditional Owner Corporations worked in partnership with Victorian Traditional Owners, Aboriginal Victorians, Forest Fire Management Victoria and the CFA during 2017–18 to develop a Victorian cultural burning strategy. This has involved supporting a practice network of Traditional Owner fire knowledge-holders across Victoria, who want to build practice knowledge and eventually heal Country through the traditional use of fire. On-Country burns and conversations with these knowledge-holders enabled information-sharing and peer-to-peer learning about traditional fire and cultural burning practices.

For Victorian Traditional Owners, traditional fire practice means 'right fire, right time, right way for the right reasons.' A cultural burn is planned, led and implemented by a Traditional Owner who has authority on the Country on which a burn is taking place. The reasons for the burn may include increasing or protecting totem, medicine, food and fibre species, protecting sacred sites or improving passage though Country.

In Victoria, it is difficult for Traditional Owners to practice cultural burning how they want. For example, Traditional Owners seek cultural authority to plan and implement burns on the fire ground. They also seek to learn practice from elders and teach children customary fire practices, while conducting burns. Current safety protocols for fire management, which were created to suit European fire practices, make these aspirations very difficult to realise.

Also, Traditional Owners worry that traditional fire-practice knowledge could be misappropriated and used disrespectfully or without permission if shared with others.

Through conversations and engagement with Traditional Owners, the Victorian cultural fire strategy is identifying barriers and opportunities for change in the fire management sector, which would not have otherwise been known or documented. Next year, the sector will work to be much more inclusive of Traditional Owners as land management authorities, and to be much more inclusive of the land management objectives of Traditional Owners.

Safeguarding traditional knowledge is of the highest importance to Traditional Owners, because of past abuses of trust. Partnerships with Traditional Owners much consider how best to respect and protect traditional knowledge.

To Traditional Owners, much of the land we call Victoria is sick. This is because it is no longer actively cared for by them. Getting back on Country and being able to heal Country will help heal individuals, families and communities.

Investing in research

We invest in social, biological and physical research to inform decision-making. This research directly enables us to better deliver for Victorian communities and meet our obligations under the government's *Safer Together* policy, *the Code of Practice for Bushfire Management on Public Land 2012,* and the recommendations of the *2009 Victorian Bushfires Royal Commission*.

One example of the application of our research is the Phoenix Rapidfire modelling tool, developed with The University of Melbourne, which simulates fire behaviour. This tool allows us to calculate bushfire risk and make predictions of where, when and how fast a major bushfire is likely to spread. This information in turn improves community warnings and decisions about where to deploy resources. Phoenix is now used in other states as well as internationally.

We are committed to continuously improving Phoenix. In partnership with The University of Melbourne, we are currently working on a project to add fuel moisture information into Phoenix, which will improve its accuracy and usefulness.

Discussion

The project will provide:

- A web-based tool to predict landscape fuel moisture, and store fuel moisture data.
- A link to estimates of forest fuel moisture based on satellite imagery.
- Training and support to implement the tool and incorporate outputs into bushfire risk modelling for planning and operations.

The project will make the data that Phoenix uses more precise, comprehensive and up-to-date by including actual and predicted fuel moisture information for specific locations.

This is just one example of how we continually improve the quality of decision-making in fire management by investing in research. For further information on how we are investing in research, please visit our Research and Publications page on our website.

Research themes

- **Social research:** Community- understanding, impacts and values.
- **Biological research:** Hazard management, ecosystem, monitoring and resilience, Pine plantations - fuels and planned burning.
- **Physical research**: Smoke modelling, bushfire management, aircraft and fire retardant.

Sunshine diuris (*Diuris fragrantissima*)

For more than 15 years, we have worked with volunteers from the Australasian Native Orchid Society to restore native basalt grassland habitat. In March 2018, we conducted an ecological burn in grasslands at Sunshine in Melbourne's west to decrease the density of the kangaroo grass, which was smothering wildflowers. One of these flowers was the Sunshine Diuris (*Diuris fragrantissima*), a beautiful, white orchid, also known as the fragrant doubletail. It has a distinctive and attractive scent that people enjoy wafting across a sunny, native grassland plain.

The Sunshine Diuris is endangered, the only known wild population is limited to 40 individuals from a single site of native basalt-plains grassland at Sunshine. Our Port Phillip Natural Environment Program is responsible for this orchid's survival by permanently reserving the Sunshine site and delivering fire management to restore its grassland habitat. This orchid, and the native grassland habitat it exists in, are fire adapted and without regular burning face extinction. For the orchids to thrive, they need regular fires that occur during their period of dormancy – January to early March. Ecological burns are being scheduled every three to five years during the dormancy period to encourage the Sunshine Diuris to emerge from their

dormant, underground, potato-like tubers and help decrease the density of tussock grasses, which creates space for wildflowers to flourish.

We have has worked closely with volunteers from the Orchid Society to ensure that ecological burns benefit the grassland biodiversity. For the March 2018 burn, the area was searched for orchids in the weeks leading up to the burn. Two orchids – visible only as paired, tiny, grass-like leaves – were found and covered with wet ceramic pots to protect them from the burn. Other rare plants and two "bee hotels" (an artificial structure used to provide habitat for native bees and wasps that pollinate the grassland wildflowers) were protected by cutting and raking away the grass, wetting the ground and covering them with wet hessian sacks. After the fire we watered the orchid patch to alleviate the dry conditions.

The two orchids that had emerged before the burn continued to grow, as did the other rare plants, and native bees and wasps continued to inhabit the bee hotels. By winter 2018, 32 orchids had emerged, and a further 125 were planted in the burn area. Additionally, rare plants spontaneously reappeared after the burn, likely sprouting from seed stored in soil. Wildflower species include plains yam daisy (*Microseris scapigera* s.s.), geranium species, basalt peppercress (*Lepidium hyssopifolium*), tough scurf-pea (*Cullen tenax*) and button wrinklewort (*Rutidosis leptorrhynchoides*) have also been re-established at the Sunshine site. All the orchids and grassland habitat are monitored as part of a research program for sunshine diuris recovery and the research findings are used to guide recovery actions.

Ecological burning is an important part of an integrated program of management actions that has seen the re-establishment and ongoing improvement of native grassland cover over what, only six years ago, was a weed-infested site. The collaboration between our Natural Environment Program and dedicated volunteers is ensuring that wild sunshine diuris populations will continue to exist into the future.

VBMP case study

Victorian forests are some of the most fire-prone areas in the world. Through bushfire management, we have the responsibility to reduce the risk to human life and property and to maintain or improve the resilience of natural ecosystems to fire.

Through the Victorian Bushfire Monitoring Program (VBMP), we monitor, evaluate and report on the effectiveness of bushfire management for achieving these objectives. In 2017-18, the VBMP ecosystem resilience monitoring to measure the effects of fire on biodiversity.

In partnership with La Trobe University, we developed an ecosystem resilience monitoring program to collect, analyse and interpret high quality data on how bushfires and fire management affect plants, animals and their habitat in the landscape. The ecosystem resilience monitoring program has two streams; a state-wide stream to address long-term relationships between biodiversity and fire regimes across the landscape, and a regional stream to assess fire events and address immediate to short-term effects of fuel management actions (primarily planned burning) on biodiversity and regionally important ecosystems, vegetation types, or species that may not covered by the state-wide stream.

The state-wide monitoring involves surveys of flora, habitat, birds and ground-dwelling mammals at sites with varied fire history; from recently burnt, to long unburnt. During 2017-18, biodiversity information was collected at 106 sites in grassy/heathy dry forest across western Victoria. Over the long-term, approximately 2200 sites will be established across Victoria, to ensure that our fire management caters for Victorian wildlife.

During the 2018 surveys, a total of 220 plant species, 81 bird species, 27 mammal species, and four reptile species were detected. The mammal sightings included a brush-tailed phascogale, listed as vulnerable under the *Flora and Fauna Guarantee Act 1988*, in Lerderderg State Park where they haven't been recorded since 2015 (Victorian Biodiversity Atlas). The surveys provided core information on the availability of habitat features that are critical for fauna, such as coarse woody debris and hollow bearing trees. Understanding the effects of fire on these features and their locations in the landscape can help to trigger mitigation measures during planned burning operations to ensure that they are maintained and promoted in the landscape.

Data collected through the ecosystem resilience monitoring program will be used to evaluate and report on the effectiveness of bushfire management for maintaining resilient and biodiverse ecosystems. This will allow us to implement evidence-based decision making and adapt our management to improve bushfire management in Victoria for all communities.

Definitions and additional information

Area treated by other fuel management methods

The total area (in hectares) where we manage fuel through activities other than by planned burning — such as 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) where we managed fuel through planned burning 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 fuel moisture and 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)

Fire operations plans (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 planned fuel management activities on public land for the period of 2017 to 2020.

From the end of 2018, FFMVic and CFA will jointly manage operations under a Joint Fire Management Plan (JFMP) – covering all activity across both private and public land.

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 pre-planned 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 (GMA)

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.

Joint Fire Management Plan (JFMP)

From the end of 2018, FFMVic and CFA will jointly manage operations under a Joint Fire Management Plan (JFMP) – covering all activity across both private and public land.

Other burns

These are mainly regeneration burns after timber harvesting and the burning of slash piles and residues. We do many regeneration and slash pile 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

Safer Together is Victoria's approach to reducing the risks of bushfires. It focusses on how effective fuel management activities are, not just the amount of activity undertaken. Safer Together is part of the Government's response to the review of performance targets for bushfire fuel management on public land. More information is available on our Safer Together web page.

Strategic bushfire management plan

Each of Victoria's regions 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.

Tolerable fire interval (TFI)

For any given plant community, the minimum and maximum tolerable fire interval (TFI) between successive burns is dictated by the time required for key fire response species to mature and set seed, as well as its time to extinction without fire disturbance. TFI thresholds provide minimum and maximum time intervals of fire frequency to ensure ecosystem resilience.

TFI status is reported as the percentage of vegetation on public land that is below minimum TFI, within TFI, above TFI or with no fire history.

The percentage of public land below minimum TFI is the amount currently under the minimum time threshold than what is recommended between successive burns for vegetation on that land. For example, if a recommended minimum TFI is 15 years for a given vegetation and it was last burnt 10 years ago the land is below the minimum TFI and will continue to be for another five years.

The percentage of public land above maximum TFI is the amount that remained unburnt longer than what was recommended. If a community was burnt 10 years ago and the maximum TFI is 30 years, it should be burnt again in 20 or more years.

The percentage of public land within TFI is the amount that is currently recorded as being within the recommended minimum and maximum TFIs.

The percentage of public land with no fire history is the amount in which no identifiable record of fires was found, or if the land's vegetation does not have a recommended TFI.

The larger the areas in a landscape below minimum TFI and above maximum TFI, the less resilient ecosystems are likely to be. Burning regularly 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.