

The background is a vibrant orange-red gradient with abstract, wavy, layered patterns. There are several small, dark red square shapes with white centers scattered throughout the design, particularly near the top and bottom edges. The overall aesthetic is modern and organic.

BURNING FOR LANDSCAPE HEALTH

AT EUROA
ARBORETUM





Euroa Arboretum

Growing Back the Bush

BURNING FOR LANDSCAPE HEALTH AT EUROA ARBORETUM

This brochure describes the Euroa Arboretum's use of fire for restoration of diverse grassy groundcover. We acknowledge and pay our deep respect to Taungurung elders. We acknowledge the central role fire has and continues to play in caring for Country. Our understanding is but a tiny flicker in this deep knowledge system.

It is our intention not to prescribe or direct how to use fire in this landscape, or to share knowledge that is not ours to share, but simply to describe what we have learnt about the use of fire over the last 15 years. It is our hope that in doing so we may begin to foster a better understanding of contemporary fire use in the grassy woodlands we help care for.

This work is a collaboration between Cath Olive (Executive officer, Euroa Arboretum), Bronte Haines (Grassy Groundcover Restoration Co-ordinator, Euroa Arboretum), Phil Hawkey (AFSM), Uncle Shane Monk (Taungurung Elder) and Aunty Joanne Honeysett (Taungurung Elder).





This booklet describes:

- Why and how we started using fire
- How fire helps us care for the Arboretum
- What we consider when planning a burn
- What happens on the day of a burn
- Examples of how we use fire for landscape restoration

Putting a match to the ground

We turned to fire when we realised that the ecological outcomes we desired could not be achieved with the tools we had. Despite careful and dedicated weed control with herbicide and hand-weeding, we were seeing very little change in weed loads year on year. We realised that the tools we had available to us could take anywhere between 8-100 years to break the seed cycle. Even if we were able to remove weeds and establish native ground cover, these patches would remain vulnerable to re-invasion as soil conditions would essentially be un-changed.

Fire is able to shift the balance in a way that other tools cannot. It addresses multiple parameters at once: soil conditions, weed load, biomass, and germination requirements for native species. At the Arboretum the use of fire is a soothing force. Cool burns are calm. We slow down, we breathe deeply, and watch the flames trickle over the ground. We are often burning alongside Taungurung and extend an open invitation to Traditional Owners when we burn.

We have learnt so much about the landscape and ourselves by burning alongside Taungurung. We acknowledge that grassy woodlands are managed country, and we acknowledge the many thousands of years this landscape has been carefully tended. Thank you. We care for a changed landscape at the Arboretum - full of new plant species and soil conditions. Learning how to take care of this patch together is a privilege and a joy.

A calm approach

Burning at the Arboretum is a relaxed experience. We watch ants and spiders scurry away from the flame, sprinkle precious plants with watering cans, and move sticks out of the way. We feel calm, and the flames have a way of encouraging meaningful conversations among us.

Our burns are small - sometimes just 20m ! We never burn a whole grassland at once. This ensures we leave habitat for all the critters that live there while the patch re-grows. We like to burn with just one fire front and ideally from a single point ignition. This gives critters the opportunity to move out of the way of the flame.

We do not need to do everything at once: burning small patches means we can learn when we got things right and when we got things wrong. There will always be an opportunity to burn those weeds next year.

WE'VE GOT THE SAME FOCUS -

it's all about caring for Country and doing the right thing by Country

Taungurung Elders Aunty Joanne Honeysett and Uncle Shane Monk yarn burning at the Arb.

Uncle Having a spot where we can just organise to come out and burn on a patch of country is awesome. And being able to come out with mob too. I've been burning here with Cath for more than eight years - seeing the results has been awesome. We can ring Cath here at the Arb and say look we got a few mob coming up next week is there any we can come over, and if the conditions are right, Cath's "no worries", she will join us, she's got the trailer with the tank and that for safety reasons, like, it's just.. it's just so much respect, from everyone here at the Euroa Arb, to accommodate us, to actually do our cultural practices. And every time Cath does a burn, as soon as she knows roughly when the burn is going to happen she also reaches out: "any of yous available to come?" Like, that's just respect.

Aunty Culturally it means so much, for us, obviously, to practice our culture, and up here we're able to do that. We work for the same outcomes. You know it's a partnership, it's a friendship, it's love, its trust, and you know, the fire that it puts in my belly, literally, that feeling of doing those cultural burns. I've only been a part of two, but the feeling I get is a cultural feeling. This is what my ancestors did. This is what our grandfathers and our grandmothers did, and to be able to carry that work on is a real honour in itself.

Uncle We're talking with the decision makers every time every single time we come to the Arb. We say ok Cath this is what we want to do and if Cath thinks it's a good thing she'll go "yep no worries" - bang it's done. It's easy. That's how it should be with mob: if we see a patch of grassland that's ready to burn we should be able to drop a match, if it's the right time, and if we have the right safety measures in place. Right now we haven't got that opportunity. Red tape means it can take 12 months of paperwork just for a small burn. If we hadn't had the opportunity to start burning here at the Arb eight years ago we would still be waiting for our first burn.

Aunty And you know the beauty of it is to see what happens. When it's burnt what happens? To come back every couple of months after and see how things have regenerated, I guess, if that's the right word, it's just absolutely amazing. All the new things. Too see seeds growing that have been in the soil for 100 years - what a feeling that is. One hundred-year-old seeds that we're able to wake up in the ground, I mean that's pretty magic in itself. And through fire all the things that we don't want, we can get rid of, and the things that we do want we can encourage to grow. So we feel like we've got a lot of control, like our ancestors did, over our Country.

Uncle Nothing has ever been documented in our culture. It's all handed down through oral stories and dancing and song and songlines. A lot of this information has been made dormant, and we're slowly waking it up. So to actually start seeing the change of the environment from putting a cool burn through is just amazing. Every time we do a burn, we learn. Sometimes it's: ooo that didn't work properly that time we might have to burn a little later or a bit earlier to get rid of that weed. Sometimes it's perfect.

Uncle We also have an opportunity to bring our young ones out to burn. We have our young ones around a fair bit. We can go out and practice any other part of our culture: we can show them how to do coolamons, collect materials for making stone tools, spears, all that stuff, but we haven't got somewhere where we can just go out, as a group, and just put a match to the ground, and see what... happens. We've got that here.

Aunty For so long we have been unable to put a match to the ground, and you know to experience that, has been absolutely mind-blowing. All our knowledge is being improved when we burn together: it's educational for us all. It benefits everybody but overall the main benefit is for Country. And that's why we're here. And that's the good thing about us and Euroa Arb, they've got, we've got the same focus – it's all about caring for country and doing the right thing by Country. And that's the reason why it's worked out such a good partnership because we're all here for the same reason.



Mob and Arb standing around a relaxed cool burn. May 2017. Photo Phil Hawkey

WHAT WE CONSIDER

Objectives

At the Arboretum we always have an ecological outcome in mind when we plan a burn. What we want to achieve will influence how and when we burn. Our objectives usually include one or more of the following:

- To reduce biomass in healthy grassland and create space between the grass tussocks to allow lilies and forbs to germinate and thrive.
- To clear annual weeds from grassland containing a mix of native and non-native grasses.
- To reduce dense leaf litter and stimulate the germination of dormant native seed.
- To restore favourable soil conditions for indigenous species by reducing soil nitrogen and removing deep eucalyptus leaf litter.
- To clear an area of dense weeds so that we may begin the process of restoring a new patch of land.

Site Knowledge

- Species composition and growth habits

Good knowledge of the current suite of species in the site is critical. This kind of knowledge can only be gained through at least two years of careful observation. If we are familiar with the site and understand the growth habits of the species present, we feel confident we can apply fire that will have positive outcomes.



Bulbine bulbosa, flowering in healthy mixed native grassland at Euroa Arboretum. Image BH

Knowing what species are present is particularly important for grassy sites as not all species are always visible. Consider our precious lilies. If we did not see them hiding among the grass and burnt this site in late autumn we would burn off their new shoots. These tuberous species have limited capacity to recover from such a set-back as they have just exhausted their energy reserves sending up new shoots. Similarly, the weedy annual grass Sweet Vernal germinates mid winter. If we assessed a site just once in autumn we may miss the presence of Sweet Vernal. An autumn burn may unintentionally open up the sward for Sweet Vernal expansion in spring.

Knowing which species are present and their growth habits can be the difference between a burn that benefits native species, accidentally harms precious species, or gives weeds the upper hand.

Site Knowledge

- Perennial or annual grasses?
- Warm or cool season grasses?



Poa labillardieri. Cool season grass re-sprouting after an autumn burn. Image BH

We have many challenges in groundcover restoration, but fortunately we are still in a position where most of our weeds are annual grasses, and the vast majority of our native grasses and forbs are perennial. This means that - if we get the timing right - we can burn away the annual grasses before they set seed, and provide the space for native perennials to bounce back quickly.

How quickly groundcover recovers after a burn is highly dependant on the growth habits of the species present.

Grassy ecosystems include grass species (both native and introduced) that are actively growing at different times of the year. Cool season grasses grow under lower light and temperature conditions. Conversely, warm season grasses kick-off in late spring and summer. Once again, timing is critical when burning these species.

For example, burning grasslands with a high composition of summer active species in autumn, such as *Eragrostis* spp., *Themeda* spp., or *Bothriochloa* spp., would result in slow recovery of these tussocks. The ground would remain open and susceptible to weed invasion for many months. On the contrary, a spring burn at the same site would mean a quick recovery to appropriate density. Under this scenario space, water, and nutrients are quickly taken up by indigenous species, leaving fewer opportunities for weeds to germinate and establish.

Wind



Backing burn: Observe the fire front trickling into the wind. Also note smoke travelling the opposite direction. Image BH

Windspeed and direction affect fire behaviour.

We burn with a light, stable wind. To keep an eye on wind behaviour we tie a ribbon to an upright stake. The maximum windspeed we consider burning in is 18km/hr, and then only if the wind direction is stable. This is a rare occurrence as we prefer calm burns.

We mostly work with backing fire. This means that the fire is travelling into the wind (If the wind is blowing from the south-east, our fire is heading south-east). This helps to ensure that the fire is gentle, predictable, and covers the ground evenly. As a general rule, backing fire moves at a quarter of the speed of the wind.

Fire that travels with the wind behind it is called heading fire. Heading fire can move quickly, be more unpredictable, send embers ahead, and result in patchy coverage. That being said, in some circumstances, it is the right tool for the job.

Fuel

- Type, load, and arrangement



The oil glands in *Pultanea humilis* sizzle and pop as they fuel the fire. BH



A cool burn leaves woody debris on the ground. Here we have left small logs, and extinguished them with watering cans. Note we have also protected some small native peas. Image BH

- Do we have enough fuel?

Fuel type, load, and arrangement affect fire behaviour. Plant material with higher carbon content, such as sticks and leaf litter, burns hotter than most grasses or forbs. For example, the more eucalypt leaf material on the ground, the hotter the fire. Similarly, plants with a high density of oil glands will burn more intensely. After fire has passed over the ground we can observe which areas burnt hotter by the colour of the debris remaining: white debris indicates that this area burnt hot, and black, cooler.

As a general rule in grassy landscapes, we expect a flame height twice the height of the plants. At the Arboretum we are generally (but not always) burning areas with low to medium fuel load. However, some grassy situations can be more dangerous. For example, weedy perennial grasses such as *Phalaris* spp. can grow to over a metre and often contain a lot of dry chaff. They can therefore produce tall, hot flames. Similarly, *Poa labillardieri*, despite growing in wetter conditions, burns tall and hot.

If required we can reduce fire intensity by rearranging fuel. If we are planning to burn an area with tall, thick grass, we may slash or brushcut to reduce the flame height. If we would like to burn an area with lots of woody debris, we consider either moving logs out of the burn zone, or wetting them down. As well as reducing risk, this keeps habitat in the landscape and reduces the possibility of the fire flaring up after it has been extinguished. It also saves us time as we do not have to monitor smouldering logs.

Vertically connected fuel, for example tall grass growing into acacias, and acacias touching eucalypt bark, can draw fire into shrubs and trees. We generally burn under weather conditions where the risk of flames travelling into trees is low. We can reduce this risk further by wetting down the bark of trees.

Usually people focus on having too much fuel, but we are often thinking about whether we have enough! In sites dominated by annual grasses there can be a lack of dry material to carry a flame, especially in spring. This makes us think carefully about whether we want to use our fuel at a given time. Do we really want to burn this site now, given it may be two years before we have enough fuel to burn it again?

We are experimenting with hand-planting native grass tussocks in amongst weedy annuals so that when it comes time to burn patches again in a couple of years, we have fuel to carry a flame.

Humidity

Humidity is highest during the morning and evening. It can help manage fire behaviour to achieve desired outcomes, and also mitigate risk. The higher the humidity, the less intense the fire will be.

In autumn we will usually need to wait until late morning for the ground to dry out and the humidity to drop so that the flame may travel.

In spring, especially if it has been dry, we may begin to burn earlier in the morning so that we can finish up before the heat of the day, when fire behaviour can intensify. We could also wait to burn until the evening when the humidity rises again.

Soil Moisture/ Drought Factor

The Drought Factor is an indicator of soil moisture content or soil dryness. When burning it is important to be aware of soil dryness as this can contribute to fire behaviour. The dryer the soil, the more available surface fuels are for combustion. Damper soil will influence the moisture in the plant and slow down the combustion process.

Follow-up

Immediate

We always keep a watchful area on a site after extinguishing a burn. At the Arboretum we wet down the outside and inside edge of the burn and turn "grey to black". We put out any remaining smouldering logs and check the site for hot patches. We check the burn site the next day, paying extra attention to logs and around the base of trees.

Longer term



Chrysocephalum apiculatum re-spouting after an autumn burn. Image BH

A burn is always part of a larger plan for a site. Time and labour are precious and there is much to do! Planning for follow-up starts before a burn.

While fire it is our most effective tool, when compared with the rest of the toolbox, we have the least opportunity to use it. Special significance is therefore placed on timely follow-up.

Occasionally, if our site assessment and timing are correct, no follow-up will be required. But usually the burn is only a first step. We may flame-weed any undesirable germinants while they are young, address them with a selective herbicide, or spot-spray perennial weeds that re-shoot after a burn.

PREPARING FOR OUR BURNS: OBJECTIVES, METHODS, BOUNDARIES

Before we begin a burn we consider our objectives, determine how we will achieve them, and set our boundaries.

- We ensure everyone is clear on the objective of the burn and the current site conditions. For example, this may be to reduce Sweet Vernal density in a healthy native patch with orchids, or burn off a dense leaf litter layer so that we may sow native grass seed.
- Given our objective and site conditions we establish our methods. For example; if the wind is blowing south east, we will light our fire from the northern edge of our desired burn area so we may utilise backing fire. Conditions are mild, so we will use water to create our fire break.
- We determine the desired size of our burn and establish physical and temporal boundaries. For example, we will burn only the area of grassland with dense Sweet Vernal (approx 60m²), using the walking track as a boundary on the north side; we will not burn under that eucalypt with dense leaf litter; we will aim to finish our burn by 2pm as the weather forecast is for gusty winds in the afternoon.



Reducing Risk

Are there risks in the area we need to consider? Can we mitigate them?

Apart from weather conditions and fuel load, one of the more pertinent risks at the Arboretum is the presence of eucalypt borer in some of our old trees. This insect drills extensive networks of small cavities in tree trunks. Fire can travel through these networks. These trees are difficult to extinguish and require monitoring for days if not weeks to ensure they do not flare up.

Similarly, the base of some of our old trees have a thick layer of leaf litter that can hide holes where roots have decayed. There is a risk that fire can burn down into the roots and continue to smoulder. The risk of flare ups is greater in spring as conditions warm.

We will determine if we have any high risk trees around a burn and leave a large break around them.



PREPARING FOR OUR BURNS: PROTOCOLS AND SAFETY

After careful consideration of our objectives and a thorough site assessment, we register our burn with Fire Permits Victoria, prepare our equipment and site, and conduct a small test patch to gauge fire behaviour.

Conducting a Test Patch

We are usually reasonably confident about how a fire will behave, however we can never be certain. Because of this we always begin by conducting a small test patch.

We do this by slowly drawing a small circle approximately 1m in circumference with a watering can. This creates a small fire break. We strike a match directly in the middle of this circle and observe which way the fire travels, and how quickly.

If the fire gains momentum too quickly we will abort plans and try again another day.

Please note that these are the safety procedures we have developed at the Arboretum: they relate to grassy woodlands and burns conducted outside of the fire restriction period on private land.

- We are required to register our burns before commencement through Fire Permits Victoria. www.firepermits.vic.gov.au
- We ensure we have at least two people who are comfortable to conduct the burn: i.e. people who understand how the fire is likely to behave, where the taps are, and/or how to start the pump.
- We ensure sufficient water access and that all taps and/or pumps are working and contain fuel. At the Arboretum we use a 1000L trailer tank and have the luxury of a number of taps in the grounds that are fed by a large dam
- We always wear appropriate Personal Protective Equipment, including non-flammable long sleeve shirts and long pants, as well as sturdy shoes such as leather boots.
- We consider what tools will help control the burn. We usually take two rakehoes. They can be used to create a small earth fire break by raking back leaf litter, to extinguish small flames by stamping them out, or roll over a hot log. But by far our favourite tool is the watering can. We always take two. We use them to create a "wet edge", protect plants or woody material that we do not want to burn, and to put the fire out. The trailer tank is close by in case of emergency. We generally only use it to fill our watering cans but sometimes we will use it to wet down the base of trees.



MAINTAINING HEALTH:

The Arboretum Grasslands

We burn our grasslands to maintain their diversity. This includes burning to reduce biomass, and to reduce weed density

Our grasslands

At the Arboretum we have a mix of grassy woodland and open grasslands. The majority of our open grasslands were established through a technique known as soil scalping. At the Arboretum this involved the removal of the top 10cm of the soil profile. This exposed low nutrient soil with no weed seeds. Two patches were then sown with a diverse mix of native seed; one in 2015 and one in 2019. As time passes plants gradually rebuild the top-soil, and we find the grasslands are becoming more susceptible to weed invasion.

These grasslands are now home to over 60 different plant species including rare and threatened daisies, lilies, and orchids. *Rytisopserma* spp. and *Stipa* spp. comprise the dominant tussocks with *Themeda* spp., *Eragrostis* spp., *Bothriochloa* spp., *Aristida* spp. and *Anthosachne* spp. present in smaller patches.



Healthy native grassland 10 years on from establishment. Great diversity and biomass at an acceptable level. Image BH

Why we use fire

If left unmanaged grasses can become thick with old growth and crowd out smaller non-grassy species. Burning creates gaps between tussocks. These gaps are known as the inter-tussock space. Healthy inter-tussock space is essential for grassland diversity as it facilitates the persistence and germination of forbs and lilies. This bare soil is also essential for many local critters like lizards and ground-nesting bees and spiders.

How quickly biomass accumulates depends on soil nutrient levels, rainfall, and species composition. *Themeda triandra*, for example, is more likely to build up over time as its chaff is resistant to decay. *Themeda* dominated grasslands therefore require more frequent management compared to those dominated by *Stipa* spp., for instance.

An addition to managing biomass, we use fire to control annual weeds such as *Vulpia* and Sweet Vernal. Fire can kill weedy annuals before they set seed leaving space for our perennial natives to germinate and re-sprout.



Healthy inter-tussock space between wallaby grass 6 months post burn. This patch could be oversown with forb seed.

REDUCING SWEET VERNAL IN ARISTIDA



Dense sword with Sweet Vernal choking the inter-tussock space. 12 September 2023. Image BH



Immediately after the burn: great even flame coverage



Seven months on. *Aristida ramosa* after one season of growth. Good inter-tussock space. 12 April 2024 Image BH

Site Assessment:

Native grassland comprised predominantly of *Aristida ramosa* and *Rytidosperma* spp. with no indigenous forbs or tubers present. Sweet Vernal is present throughout and dominates the inter-tussock space. It is September: Sweet Vernal is flowering; *Rytidosperma* spp. are actively growing; *Aristida ramosa* is still dormant. *Eucalyptus microcarpa* surround the site. They have Veldt grass growing under their canopies and moderate leaf litter. Burn area approximately 100m².

There was a light southwesterly wind. Grass was a little damp but there was adequate dry material well-dispersed throughout the site to carry a flame.

Objective:

To reduce the prevalence of Sweet Vernal and create healthy inter-tussock space.

Risks:

Aristida spp. are also known as fire-cracker grasses. They are highly flammable and could result in a hot flame. Leaf litter under trees could hide holes from root decay where fire may smoulder.

Method:

We burnt this site in spring to allow quick recovery of summer growing grasses. Given the site was a little damp in the morning we waited until 1pm for the patch to dry out. The fire was lit from a single point ignition from the north-east side of the patch producing a gentle backing flame travelling south-west. A wet edge was created with watering cans on the west side of the burn. Peas were protected in the patch by sprinkling them with watering cans.

Outcomes:

A beautiful burn! We had good coverage and removed most Sweet Vernal from the site. A small patch of dense green Sweet Vernal (10m²) did not burn as there was no dry material to carry a flame.

Follow-up:

October 2023: Flame-weeding to address unburnt Sweet Vernal. August 2024: Fulsilade (70mL/10L water) to address Sweet Vernal germinants in unburnt patch. November 2025: summer rain event meant we could oversow with a mix of forb species after soil aeration.

BURNING TO RESET

Restoring new patches of the Arboretum

We often use fire to begin restoring new patches of the Arboretum. Fire can physically clear a site of dense weeds and dense leaf litter, and encourage germination from the soil seed bank.

New Patches

The Arboretum was grazed from 1860, and then used as a depot for the Hume Fwy bypass in the early 90s. Because of this the land suffers compaction and nutrient enrichment, particularly under trees where stock have camped in the shade. This is a common issue across temperate Australia. It has been difficult to shift the dynamics of these patches to favour native groundcover and we have seen very little change in these areas even 35 years post grazing. Indeed this is one of the key reasons we began working with fire.

Patches under remnant eucalypts at the Arboretum are often dominated by annual Veldt grass and Wild Oats, and after the wet years of 2022 and 2023, some patches of perennial Yorkshire fog have established.



A burn under *Acacia implexa* and around remnant Eucalypts. Conducted July 2024. We targeted Sweet Vernal and Yorkshire Fog. Yorkshire fog spot-sprayed in summer. Image BH

Why we use fire

We use fire to begin restoring new patches because it can shift many parameters at once. It is part of a minimum 5 year plan to bring biodiversity back to a patch.

The soil surface of nutrient enriched sites is often covered with weedy biomass: either living or as last years' chaff. This leaves very little space for native groundcovers to establish and thrive. Fire clears away this biomass. Note in the photo (bottom left) dry Veldt grass outside the burn zone.

Sometimes biomass can be so thick we are unsure what plants are physically present, or weedy perennial grasses can be so chaffy there is little new growth to effectively spray them. After we have burnt an area and plants begin to re-sprout we can use less herbicide and be more targeted in our efforts.

In addition to weeds we often see a deep build-up of leaf litter under trees in modified grassy woodlands. This is likely due to changed soil nutrient dynamics; modified fungal and bacterial communities; less soil turnover with the loss of small digging mammals; as well as the obvious loss of traditional fire regimes. Re-introducing fire can burn down this leaf litter and allow space for germination.

While nitrogen cycling is a more complex process than what we describe here, fire can volatilise nitrogen stored in plant leaves. It is our observation that "burning off" nitrogen, over a number of years, can help tip the balance to favour native groundcover establishment. After a burn perennial grasses draw nitrogen out of the soil when they re-sprout, and annual grasses do not get a chance to compost back into the soil.

If hot enough, fire can also physically destroy grass weed seeds, and break the seed dormancy of hard-coated indigenous genera like peas and acacias. It does this by physically cracking the seed coat and through smoke products that stimulate germination.

BEGINNING IN THE PENNINERVIS PATCH

Site Assessment:

Patch with one remnant Grey Box (>150 years old) surrounded by 30 year-old offspring. *Acacia penninervis* dotted throughout site. Groundstory layer comprised of 100% weedy annual Veldt-grass (*Erhata erecta*). This Veldt grass is an annual cool-season active species. It is early spring and Veldt-grass is 25cm high. It has just begun flowering and is still vibrant green. It has dominated the groundstory for 20 years. Thick leaf litter layer present, approximately 10cm deep.

This patch is in shade for most of the day. Because of this soil moisture is often high even into the afternoon during the cooler months. This has historically made this site difficult to burn.

Proposed burn area 250m². Walking tracks create a break on four sides of this site. The wind is blowing gently from the south.

Objective:

To remove thick Veldt-grass, kill grass seeds at the soil surface, and reduce dense leaf litter. To stimulate the germination of *Acacia penninervis* and *Dillwynia* spp. from the soil seedbank.

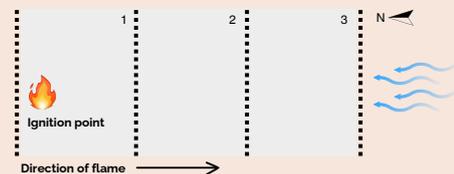
Risks:

Grey Box throughout the site have borer. There is a risk fire may enter their trunks and roots. If the fire is too hot it could kill some acacias.

Method:

Green Veldt-grass was treated with Glyphosate in September, three weeks prior to the burn. This created standing dry material to carry a flame.

Given this was a higher risk burn the patch was split into three sections by creating four one metre earth breaks running east-west (figure. 1). Leaf litter was raked away from the base of trees. The fire was ignited inside at the northernmost edge of the burn area, inside the break. This created backing fire that slowly moved south to the next break. Fire was applied to the remaining two thirds in the same manner.



Outcomes:

A hot burn with good coverage reduced the depth of leaf litter. We saw germination of *Acacia penninervis* and *Dillwynia juniperiana*. Although this fire would have killed some Veldt-grass seed, much still germinated the following autumn.

Follow-up:

September and October 2022, 23: Use of Glyphosate (10mL/10L water) to spray Veldt-grass before seed-set. Handweeding larger plants in late spring. Handplanting of forbs in clear patches. April 2024: Fusillade (70mL/10L water) and flame weeding to reduce *Vulpia* and Veldt grass.



The Penninervis Patch. This patch was full of Veldt grass. This picture is taken in summer after it has cured. Image CO



Diverse understory of daisies and shade-loving grasses including *Xerochrysum viscosum*, *Wahlenbergia* spp., *Rytidosperma pallidum*, *Rhodanthe anthemoides*, spring 2023 Image BH

FLAME WEEDING

When a flame wont carry

We use a flame weeder when it is too wet for a flame to carry, or when there is no fuel to carry a flame.



Burning leaf litter after a frost. July 2024. Image BH

Flame weeding

In the last five years we have encountered more *Vulpia* spp. at the Arboretum. This fine, weedy annual has been popping up in areas where we have effectively tackled larger weedy grasses like Veldt and Wild Oats. It is small (sometimes just one stem) and can grow under low nutrient conditions, because of this it can invade otherwise healthy native patches. This species germinates in dense swathes in mid-winter, seeds quickly in spring, and then falls over creating a dense carpet that smothers other plants.

We were increasingly uncomfortable using herbicide on *Vulpia* because of the impact on the native plants it grows in-between. It has also been nigh impossible to spot-spray as it germinates as a carpet. The use of a flame weeder has been a revelation in tackling small annual grasses.

The flame weeder is a very specific tool. It can kill some weeds, but not others, and is not effective at all stages of growth. For small species like *Vulpia* and Sweet Vernal flame weeding is effective even when plants are mature, but Veldt-grass and broad-leaved weeds must be flamed when young (three shoots or less).

While the flame weeder does a wonderful job on certain tasks, after three years of use, we know that it is not as effective as a burn that carries from its own fuel. Flame weeding usually only addresses the biomass issue. Although, it can be more targeted than a cool burn.

How we Flame Weed

We use a "Cobra" flame weeder with a regulator on a 9kg LPG bottle. This is on a little trolley and secured safely so the gas bottle remains upright. We always take watering cans with us but rarely need to use them.

When it is very wet, the flame weeder essentially steams weeds (we can burn in light drizzle!), blanching leaves so that they turn from bright green to lime is sufficient for a kill if the plant is small enough. When there is moderate moisture, the flame weeder can completely burn away weeds, and when it is a little drier, the flame may carry a little. This may be the case after we have had a frost and the soil moisture is lower. When the flame is able to carry a little from fuel on the ground the outcome is always superior.

Ecological Precautions

Because we can apply fire to plants without the need for fuel on the ground, there is a risk of burning native species too often. Even though most natives respond well to fire, burning too frequently reduces energy reserves and it can take a long time for plants to recover. This is of particular concern when we have annual weeds that can have multiple germination events in one season. It can be better to let small species like *Vulpia* grow larger before flame weeding, reducing the chance of a second germination after a site has been flame weeded.

In some circumstances it may be better to leave weeds seed than to stress native species.

THANK YOU

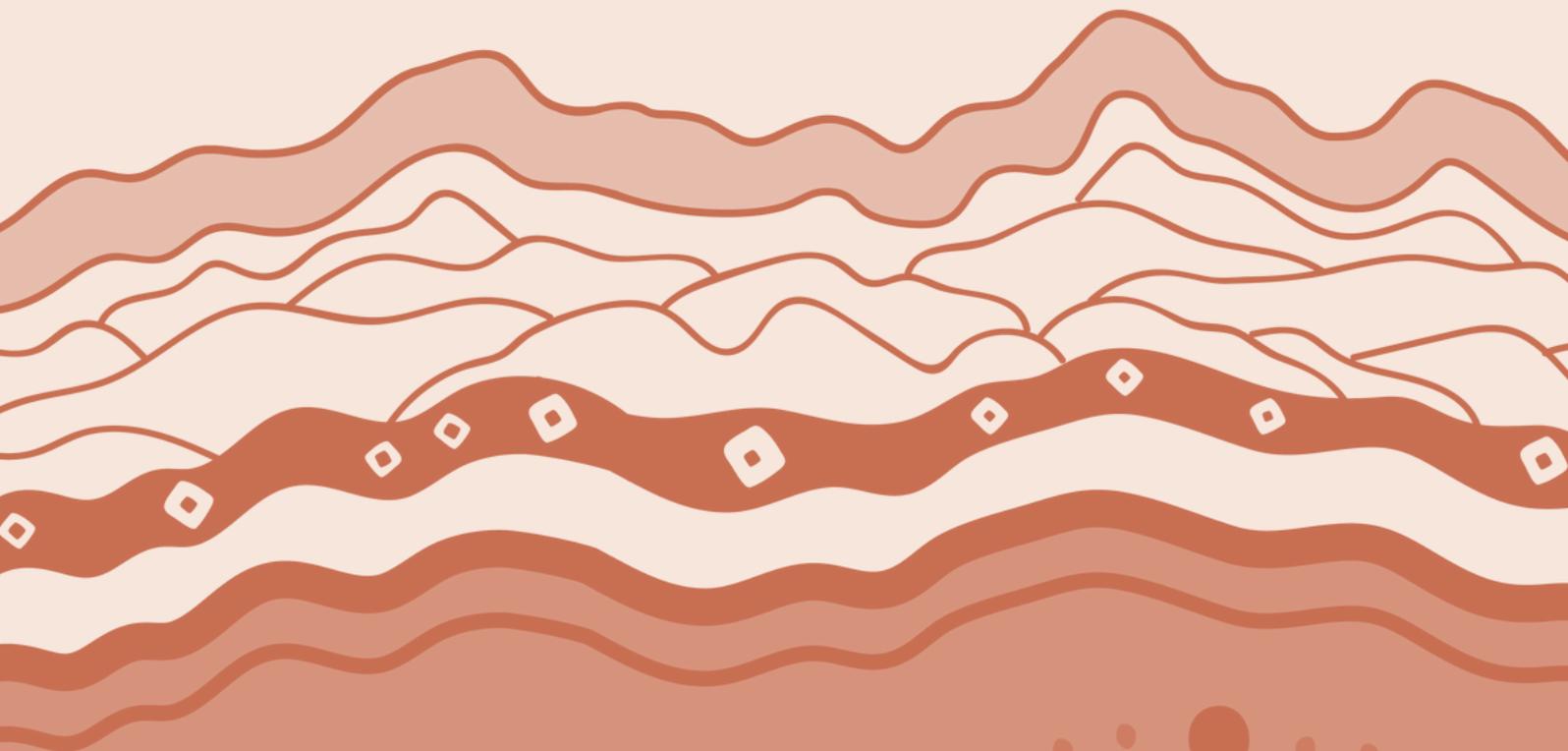
This booklet weaves together the knowledge of many people who have loved and cared for the Arb over the last 15 years.

Our deepest love and gratitude to Country.
You have taught us so much.

Aunty Jo and Uncle Shane - your friendship and guidance has helped us imagine and practice new ways of being in relationship with Country. Thank you.

Phil Hawkey your steady hand, depth of knowledge, and commitment to revitalising old ways/forging new ways of caring for this patch has been astounding and inspiring. Thank you.

Our deepest gratitude to the flame -
for looking after us and the earth.



OUR COUNTRY

This illustration was chosen as it both depicts the textures of Country, while also representing slow burns across the landscape. This can then be seen in the line work that trickles in between the two larger elements, representing the fire's path and as it cools.

It has been a pleasure to be asked to provide design and illustration for this booklet and it has been very interesting to read about the slow burning methods being used at the Arb. What an amazing opportunity for learning and growth.

Thank you for sharing,

Maddi Moser, Taungurung Mob

