Designing gardens for bushfire-prone areas, rev 19/6/2023

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Contents

First – a brief recap on basic bushfire safety: [1]

Do you have a bushfire survival plan? If not, see the first reference. You can get a hardcopy from your local bushfire brigade.

Or you can do it online here https://www.myfireplan.com.au/.

One of the most important things to do before a bush fire is to decide what you will do if one should start in your vicinity (noting that they can travel fast!). The options are:

- Leave early. When? Where will we go? How will we get there? What will we take? Who will we tell? What is our backup plan if it turns out not to be an option?
- Decide to stay. Are we well prepared? Do we have the equipment we need? When do we start defending? Does everyone know what to do? What is our backup plan? Be aware that some fires are so catastrophic that staying is not an option even if you are well prepared.

Equipment checklist if you decide to stay

- firefighting equipment
- personal protection equipment.

Action checklist if you decide to stay

- before
- during
- after.

Make your home and property safer, things you should do include:

- Trim overhanging trees and shrubs.
- Mow grass to have a cleared area around your home.
- Remove material that can burn including from gutters.
- Organise hoses and a reliable water supply.
- Ensure access for fire tankers.
- Keep water tanks full and connect them to pumps.

Know the bushfire alert levels and what they mean – advice, watch and act, emergency.

Know the fire danger ratings and what they mean – moderate, high, extreme, catastrophic

Have relevant information: phone numbers, emergency broadcaster channels, websites, the *Hazards Near Me NSW* app.

Make a habit of checking your local weather forecast: temperature, wind strength and direction.

A well-designed garden is a wonderful place, providing:

- shade and cool areas to reduce ambient summer temperatures
- shelter from the wind
- habitat for native animals and
- spaces for growing food.
- and just somewhere nice to sit in – or look out at!

Increasingly, we need to factor in the garden's role in protecting us and our properties from bushfires…

… and ensure that its design and plantings do not actually *increase* the risks from bushfires.

The garden in context: bushfires and their behaviour [2,3]

The main ways buildings are destroyed or damaged during a bushfire are:

- ember attack
- radiant heat
- direct flame contact.

… And there are three major factors that influence bushfire behaviour:

- Topography: fire burns faster uphill; as the slope increases, so does the fire's speed and intensity.
- Weather: hot, dry and windy days provide ideal conditions for a bushfire.
- Vegetation: plants are the primary source of fuel for a bushfire; understanding how vegetation influences fire behaviour is important when planning a garden. Fuels can be categorised as:
    - fine (represented by grassland and leaf litter)
    - intermediate (represented by scrub)
    - dense (represented by forest).

Well-placed vegetation with low flammability may help protect houses by:

- deflecting and filtering embers.
- reducing the amount of radiant heat received by a house
- reducing the chance of direct flame contact on a house
- reducing wind speed around a house.

General garden design aspects for bushfire protection [2,3,4,5,6,7]

Houses should ideally be located away from unmanaged vegetation and steep slopes.

Houses should ideally be located close to well-maintained public roads and accessways.

- access for fire tankers is very important.

Non-plant landscaping elements may contribute to bushfire risk, for example:

- wood mulch
- timber decks
- brush fencing.

Other things around your house that can burn include plastic pots, hanging baskets, shadecloth sails, door mats, outdoor furniture, canvas awnings.

Water supply should be sufficient and accessible in the event of a fire, for example:

- to run a sprinkler system to wet the house and flammable mulch and decks
- to run hoses to extinguish embers and wet the house, vegetation and flammable areas.

You will need sufficient capacity in tanks or dams for your own needs and to potentially provide water for fire tankers.

Good placement of taps will allow you to run hoses to extinguish embers.

Power will likely go off during a fire, so, unless you are on town water, emergency watering supply should be gravity fed or run by a generator.

Site water tanks away from likely fire fronts and ensure you have enough tank water specifically for plant hydration.

If possible, select drought tolerant plants. If you use bore water, choose plants that will cope.

Dense, continuous vegetation near the house can create a bushfire risk:

- Break up continuous vegetation with: driveways, paving, paths, water features.

Combustible things like woodpiles, wooden sheds, mulch piles etc. should be located away from the house.

The concept of asset protection zones [4,5]

The NSW Rural Fire Service (RFS) describes asset protection zones (APZ) in some detail (see references).

An APZ is located between an asset and a bush fire hazard and is intended to protect buildings from bush fires.

- Its size depends on the nature of the asset, the slope of the area, the type and structure of nearby vegetation and whether the vegetation is managed.

An inner protection area (IPA) within the APZ should be highly managed. Within the IPA:

Trees:

- Canopy cover should be less than 15% at maturity.
- Trees at maturity should not touch or overhang the building.
- Lower limbs should be removed up to a height of 2m above the ground.
- Tree canopies should be separated by 2 to 5m.
- Preference should be given to smooth barked and evergreen trees.
- Plant trees well away from buildings so that, if they fall, they will not hit them.

Shrubs:

- Create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings.
- Shrubs should not be located under trees.
- Shrubs should not form more than 10% ground cover
- Clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.

Grasses:

- Grass should be kept mown.
- Leaves and vegetation debris should be removed.

An outer protection area is located between the inner protection area and unmanaged vegetation. It is only applicable in forest vegetation.

There is a methodology for calculating the size of an APZ [5]. An example is provided below.

Calculating the size of an APZ [5,Appendix 1]

Identify APZs: four scenarios for our region

1. Determine vegetation formation in all directions around the building to a distance of 140 metres: **DRY SCLEROPHYLL FOREST** or **GRASSLAND**
2. Determine the effective slope of the land from the building for a distance of 100 metres: **>0°-5°** or **>5°-10°**
3. Determine the relevant Forest Fire Danger Index (FFDI) for the council area in which the development is to be undertaken (refer to A1.6). **FOR YASS VALLEY IT IS 100.**
4. Match the relevant FFDI, vegetation formation and effective slope to determine the APZ required from the appropriate table of this Appendix to determine minimum distances for APZs.

Results

Vegetation	**Effective slope >0°-5°**	**Effective slope >5°-10°**
Forest (dry sclerophyll)	29m	36m
Grassland	12m	13m

Vegetation clearing rules in NSW [8]

The 10/50 Vegetation Clearing Scheme gives people living near the bush an additional way of being better prepared for bush fires. The scheme allows people in a designated area to:

- Clear trees on their property within 10 metres of a home, without seeking approval; and
- Clear underlying vegetation such as shrubs (but not trees) on their property within 50 metres of a home, without seeking approval.

You can find out more about the conditions and if your property is in a 10/50 Vegetation Clearing Entitlement Area using the RFS online tool. [8]

The concept of defendable space [2]

The Victorian Country Fire Authority (CFA) defines *defendable space* as "an area of land around a building where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire."

An *inner zone* "is the area immediately around the house. It provides separation from fuel sources, reduces radiant heat, eliminates direct flame contact and reduces ember attack. Vegetation needs significant and intensive management." CFA suggests a width of 10 metres for the inner zone. An *outer zone* "sits between the inner zone and unmanaged vegetation". CFA suggests that the outer zone can be defined by the land clearing rules applying in Victoria, that is an additional 20 metres in a bushfire prone area.

Plants in general [2,6,7]

*****All plants, even *low flammability* species, will burn if conditions are right.*****

Suitable plants can be native or exotic.

Plants **less** likely to burn are:

- deciduous plants
- plants with high moisture content in their leaves
- plants with low volatile oil content
- plants with smooth bark
- plants with open and loose branching
- plants with broad or fleshy leaves
- plants with salt in foliage (e.g. many silvery-grey leafed plants).

Grasses:

- Choose grass species that stay green during summer (though CFA has noted that *Phalaris* will burn when green).
- Keep lawns moist and mown to <10cm.
- Note that CFA considers all grasses taller than 30cm to be extremely flammable.

Hedges can be problematic or beneficial

- can be helpful if strategically placed with the right plants and well watered.
- But they may funnel fire towards buildings.
- May be flammable because of an accumulation of dead material.

Maintain plant health – an unhealthy plant may be more flammable than a healthy one.

All plants accumulate dead leaves and twigs. Regular removal is required.

- Clear base of shrubs to make it easier to remove litter.

Tall shrubs and climbers can act as ladder fuels, allowing fire to climb into the canopies of trees.

Avoid having tree canopies over buildings.

Selecting low flammability plants for bushfire safe gardens in our region [2,7]

This is not straightforward! As an example, this letter [9] from Fernandes and Cruz illustrates the difference between laboratory studies and actual bushfires.

Conditions and scientific methods differ, for example:

- lack of standardisation on experimental conditions such as ignition test temperature
- testing an unwatered plant versus a watered one
- time of year – plants might be drier in autumn than spring
- part of the plant tested – green leaf versus dead leaf.

Terminology is important (and confusing).

- *Fire retardant.* According to the CFA [2], the term can be misleading when referring to plants. It implies that a plant will not burn readily or may slow the passage of a fire. All plants will burn if conditions are severe enough.
- *Fire resistant*. According to the CFA, the term describes a plant species that will survive being burnt and will regrow after a bushfire. However, it may be highly flammable and inappropriate for a garden in a high bushfire risk area.
- *Firewise* is a term used by the CFA to refer to the flammability rating system applied to a plant. The term is linked with advice about maintenance and where that plant should be located within a garden.
- *Flammability* is a composite of factors such as ignition time, flame height and peak heat output (cited by Corbett 2021 [7]). The more flammable a plant is, the more it will promote bushfire attack.

A number of scientific studies in Australia and elsewhere have been conducted on the flammability of various plant species. Lesley Corbett [7] has put scientific and anecdotal evidence together to rate 500 Australian native and exotic species. We have cross-classified her information against lists of native and exotic plants that will grow in our region. Some of those lists have focussed on low flammability plants, others are general lists.

For a given plant, we have erred on the conservative side – If we could not find sufficient information about a plant's flammability or if evidence was contradictory or negative, we did not include it. We have listed plants that may be worth a try, in particular, if planted away from buildings. These are plants where evidence on their flammability is limited or there is a single adverse finding offset by positive ones.

Ignition tests

A direct way of determining a plant's flammability is to burn it under controlled conditions.

The U.S. Forest Service, in association with research organisations, has conducted standardised ignition tests on a number of species.

Example of a low flammability shrub, Hydrangea macrophylla Bigleaf Hydrangea (Hydrangea macrophylla) - Low Flammability shrub. - YouTube.

Example of a high flammability shrub, Mountain Laurel (Kalmia latifolia) Mountain Laurel - High Flammability shrub - YouTube.

Plants in particular: some natives [6,7,10,11,12,13,14,15]

Readers are referred to the Murrumbateman Landcare Group website for detailed information on flammability of native plants suitable for our region. [15]

A reasonably large number of native species that are suitable for our region made it into our list of low flammability plants. They include:

- *Acacia* species: *A. acinacea, A. decurrens, A. falciformis, A. mearnsii* and *A. vestita.* Several other acacia species might be worth a try, including: *A. buxifolia, A. deanei, A. decora, A. howittii, A. melanoxylon, A. paradoxa and A. ulicifolia.*
- Other trees and large shrubs: *Allocasuarina verticillata* (drooping she-oak)*, Bursaria spinosa, Coprosma hirtella* (rough coprosma)*, Melia azedarach* (white cedar) and *Solanum aviculare* (kangaroo apple). Other species possibly worth a try include: *Araucaria bidwillii* (bunya pine)*, Banksia ericifolia, Brachychiton populneus* (kurrajong), *Casuarina glauca* (swamp sheoak), *Casuarina cunninghamiana* (river sheoak), *Dicksonia antarctica* (if kept moist), *Hakea macraeana, Persoonia linearis, P. pinifolia* (geebungs), *Pomaderris apetala* (dogwood) and *Solanum aviculare* (kangaroo apple).
- Smaller shrubs: Saltbushes (*Atriplex, Rhagodia* and *Einadia*), *Correa alba, C. reflexa, Eremophila* species (emu bush), *Philotheca myoporoides* (wax flower) and *Westringia fruiticosa.* Other species possibly worth a try include: *Crowea saligna, Grevillea aquifolium, G. victoriae* and *Veronica derwentiana* (Derwent speedwell)*.*
- Ground layer species: *Ajuga australis* (Austral bugle), *Anigozanthos* species (kangaroo paw), *Blechnum Pennamarina*, *Bulbine bulbosa,* native *Carpobrotus species* (pigface), *Dianella* species*, Dichondra repens* (kidney weed), *Microlaena stipoides*, *Myoporum* species*, Pelargonium* species (native storksbill) and *Viola hederacea.* Other species possibly worth a try include: *Cheilanthes austrotenuifolia and C. sieberi (rock ferns), Lomandra longifolia, Scleranthus* biflorus (Canberra Grass) and *Themeda triandra* (Kangaroo grass)*.*
- In general, avoid: some acacias, *Allocasuarina littoralis*, *Banksia marginata*, *Callistemon citrinus*, *Daviesia mimosoides*, *Dodonaea viscosa*, *Eucalyptus* and similar genera (*Angophora* and *Corymbia*), most *Grevillea* species, *Hakea salicifolia*, *Hardenbergia violacea*, *Kunzea ericoides*, *Leptospermum* species, *Melaleuca* species, *Poa labillardieri* and *Xanthorrhoea*.

Plants in particular: some exotics [7,11,12,15]

Readers are referred to the Murrumbateman Landcare Group website for detailed information on flammability of some exotic plants suitable for our region. [15]

While our focus has been on natives, a number of exotic species are suitable for our gardens due to their low flammability. They include:

- Many deciduous trees and shrubs are likely to have low flammability. Please see list on our website. [14]
- Evergreen trees and shrubs: *Artemisia absinthium* (wormwood*), Camellia* cultivars*, Escallonia* species and *Hebe* species.
- Smaller plants: *Agapanthus* species (note that this may become weedy), *Canna indica* (canna lily), *Chrysanthemum indicum*, *Fuchsia* species, *Gazania* species, *Hydrangea macrophylla*, *H. quercifolia*, *Lavendula angustifolia* (English lavender) and *Pelargonium* species.
- Ground layer species: *Ajuga* species, *Aptenia cordifolia* (baby sun rose) and exotic *Carpobrutus* species (pigface).
- Vegetables where beds are made from non-flammable material and without vegetation mulch.
- Short, green lawns.

In general, avoid these popular exotic plants:

- *Acer palmatum* (Japanese maple)
- *Betula pendula* (silver birch)
- *Coleonema pulchellum Aurea* (golden diosma)
    - dead material in the centre of the plant is very flammable.
- *Laurus nobilis* (bay tree)
- *Lavandula* species (French and Italian lavender)
- *Olea europaea* (Olive tree)
- *Photinia x fraseri* (red leaf photinia)
- Pines, cypresses and junipers
    - *x Cupressocyparis leylandii* (interior of the tree can be filled with dry twigs creating a fire hazard)
- *Thymus vulgaris* (common thyme).

Selecting plants using a key rather than a list [16]

Following the 2009 Victorian bushfires, the CFA promotes a characteristic-based rather than a list-based approach to plant selection. Given how little information on flammability is available for many species, this approach is probably worth a try if you are selecting or assessing plants. Two examples are:

Example 1. Stringybark type eucalypt

- What type of plant is it (e.g. tree, shrub, groundcover)? TREE
- What type of tree is it (Eucalypt, conifer, other)? EUCALYPT.
- What type of bark does it have (stringy bark, sheds ribbons, neither). STRINGY BARK.

Rating: NOT FIREWISE. Trees with this type of bark are extremely flammable. This type of bark acts as a ladder, carrying fire into the canopy of the tree, and produces masses of embers. This is a common tree in our region.

Example 2. *Myoporum parvifolium* (creeping boobiala)

- What type of plant is it (e.g. tree, vine, groundcover)? GROUNDCOVER
- Is it a grass greater than 30 centimetres tall? NO
- Does the plant retain dead leaves or twigs? NO
- Are the leaves waxy or oily? NO
- Is the species seriously susceptible to disease, insects or pests? NO
- Is the plant deciduous or evergreen? Evergreen
- Are the leaves soft, thick or fleshy? YES

Rating: FIREWISE. Flammability = Low. These plants can be used in a garden as they are not known to be particularly flammable. *Myoporum parvifolium* is a low growing native ground cover; a single plant will cover a large area; it is relatively easily propagated from rootlings or cuttings.

Mulch

- Mulch is important in gardens to control weeds and reduce water usage.
- Wood-based mulches break down over time, providing valuable organic matter to the soil. However, they can be flammable (think kindling!) and should be kept away from buildings.
- Preferably keep flammable mulch kept away from buildings but if it is close to a building, wet it if a fire is approaching.
- Inorganic mulches such as pebble, stone or gravel can provide some of the benefits of wood-based mulch but are not flammable.
- Green mulches such as ground cover plants and lawns can be very valuable if kept green, short and wet during fire season.

Windbreaks [2,7]

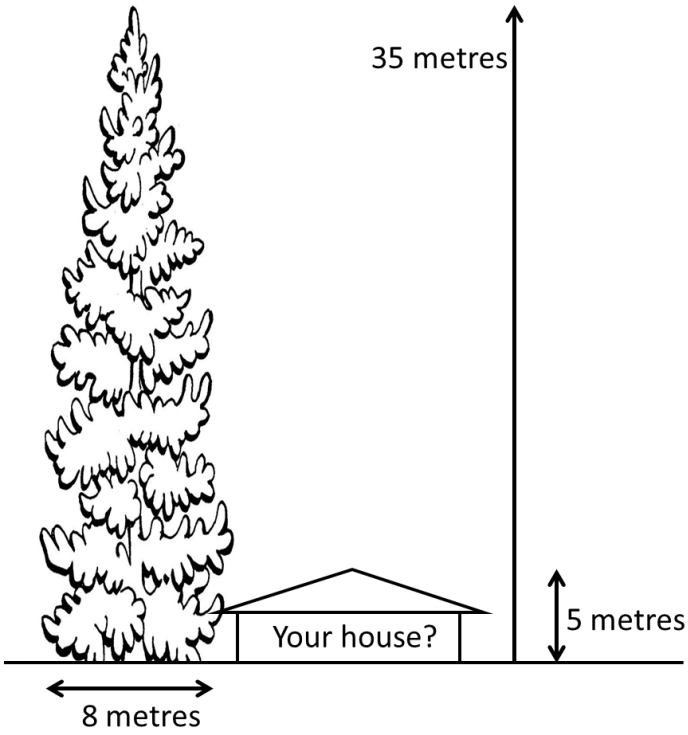
- The object of a windbreak is to slow the wind and trap embers and flying debris that would otherwise reach the house.
- The object is NOT to block the wind as that can create turbulence, making fire behaviour erratic.
- There needs to be adequate separation between buildings and the windbreak. A windbreak should not be planted within the defendable space.

An effective windbreak must:

- be located on the side of the lot from which fire weather normally approaches
- be of sufficient length (generally 100 metres minimum length)
- use suitable plants
- not have breaks of sufficient size to allow winds to funnel through
- be slashed, with well-watered grass planted underneath trees
- be maintained to remove leaf litter and other dead plant material.

Some notes on Leyland Cypress as windbreaks

Leyland Cypress is a sterile hybrid (x *Cupressocyparis leylandii)*, also known as Leylandii. It is large!



Leyland cypress plantings are popular, but pose many potential problems for the landholder. The trees:

- are fast growing
- present a fast conversion from an Australian to a European landscape
- are susceptible to canker
- are costly to remove
- accumulate dry litter
- are too dense for an effective windbreak.

Though Corbett [7] classifies Leyland Cypress as having moderate flammability (green leaf), she notes that the interior of the tree can be filled with dry twigs, creating a fire hazard.

Bringing it all together: model rural garden (CFA [2])

Orchard 2, ornamental firewise shrubs 3, front lawn 4, front driveway 5, turning circle 6, kitchen garden 8, tennis court 9, shed with chemicals 11, windbreak 14.

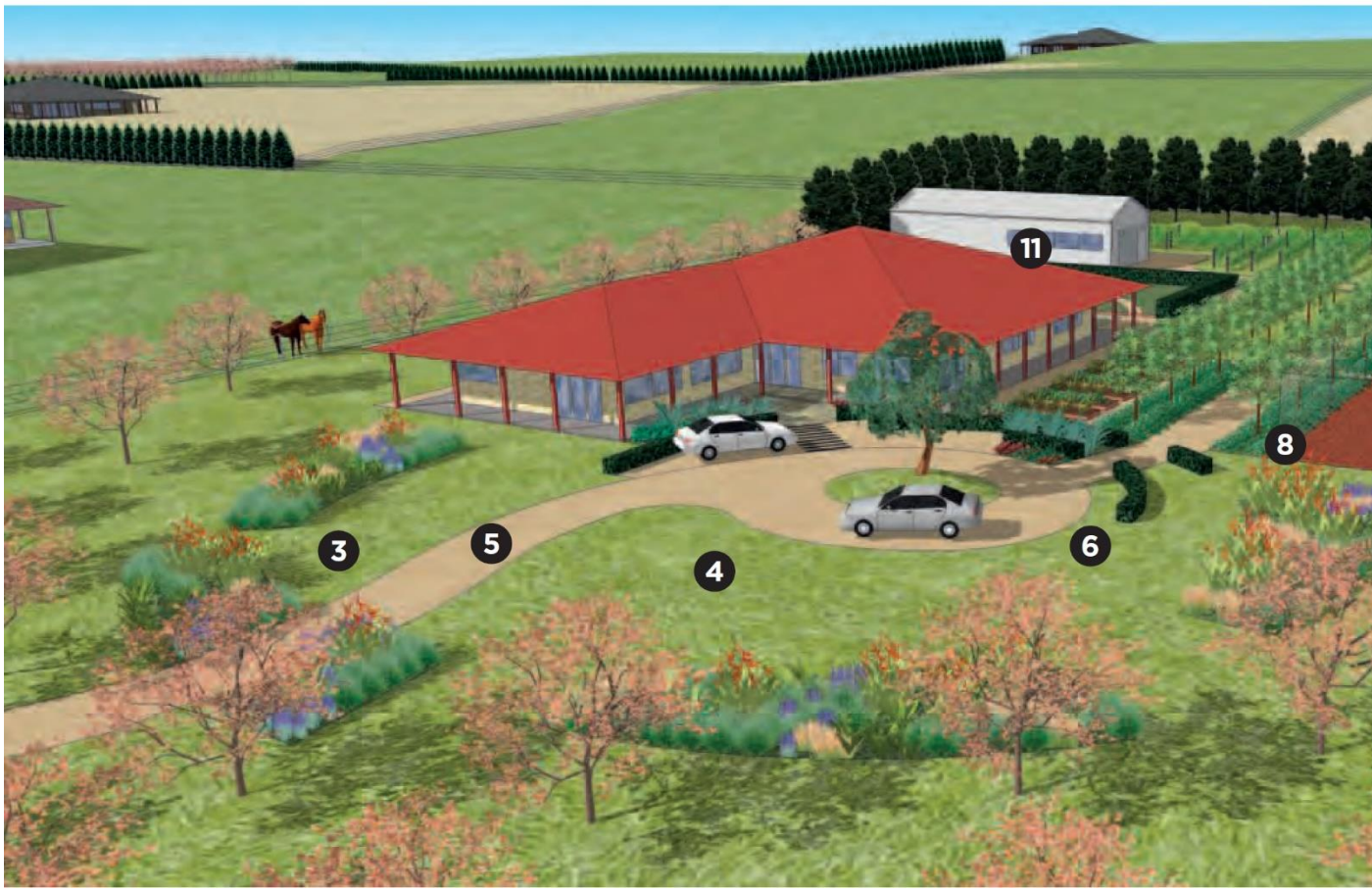
Some of the plants used in the model garden:

Windbreaks: *Acmena smithii* (Lily Pilly) on the southern boundary and *Casuarina cunninghamiana* (River Oak) on the western boundary of the home paddock.

Orchard: *Prunus* species.

Adjacent to the house: succulents and lawn.

Hedge to the rear of the house: *Escallonia* 'Pink Pixie'.



Retrofitting my garden:

Of course most of us already have a garden! Where do I start if I want to make it bushfire ready?

- Write down a plan.
- Prioritise jobs starting with the easiest/most important.
- Much of the advice in this presentation applies to retrofitting existing gardens.

Example: Gill's garden retrofit, 3 YEARS, 2021-23

Item	Jobs to do	Fire risk importance	Difficulty of job	Priority (year)
WATERING	• New tank • New sprinklers • New drippers	High	Difficult	2
MULCH	• Away from house • Gravel paths • Green mulch	High	Easy	1
LAWN	Keep green and short	Low	Easy	1
SHRUBS	Thin/remove: • some replaced	High	Moderate	2
TREES	Prune: • some removed	Moderate	Difficult	3
ONGOING MAINTENANCE	• Reduce size of garden • Year round clearing	Moderate	Moderate	2
OTHER	Access for firefighters: • track around water tanks • dam access	High	Difficult	2

A case study: the indigenous garden

Native vegetation can be *gardened* around the house in such a way as to maintain high native plant diversity and low fire risk.

Critically endangered eucalypt grassy woodland is commonly built upon in our district. With care, pre-existing plant diversity can be maintained and increased.

In the quarter-hectare around the house pictured below, 150 indigenous plant species live, including the iconic yam daisy – the yellow flower in the foreground of the photo. Naturally-occurring species have been augmented with some planting of local natives.

The 50 metre radius around the house is critical for fire safety. [17] The important elements of management are:

- avoid all use of fertilisers
- well-spaced appropriate species of eucalypts
- mowing of native grasses after flowering
- frequent raking of litter in spring-summer
- well-spaced clumps of shrubs
- paving in the immediate area around the house
- diligent weed removal
- tree branches kept clear of the ground.

Paving can be softened with short-lived self-seeding native daisies that can be removed after seeding in late spring e.g. *Leucochrysum albicans*.

Summer-growing grasses, such as Kangaroo Grass, can be kept short and green in late summer, creating a low fire risk around buildings.

References and further reading

Before you do – or redo – any landscaping, please read some of the references below!

For general information, we recommend the CFA's *Landscaping for bushfire garden design and plant selection* (free download from the Web), the RFS' *Planning for bush fire protection* (free download from the Web), Lesley Corbett's *Safer gardens: plant flammability & planning for fire* (can be purchased as hardcopy or a $12 ebook) and *Essential Bushfire Safety Tips* by Joan Webster.

For information on the suitability of specific native and exotic species, we have brought together information relevant to many species that grow in our region. See reference 15 *Detailed information on flammability of plants suitable for our region*.

1. *Bushfire Survival Plan*, NSW Rural Fire Service, Bush fire survival plan - NSW Rural Fire Service. The online version is here: https://www.myfireplan.com.au/.
2. *Landscaping for Bushfire: Garden Design and Plant Selection*, Country Fire Authority, 2022. This was developed by the CFA in response to Recommendation 44 from the Victorian Bushfires Royal Commission. It was first published in 2011; the most recent version is from 2022, Landscaping | CFA (Country Fire Authority).
3. *Landscape and Building Design for Bushfire Areas*, Caird Ramsay & Lisle Rudolph, 2003
4. *Standards for asset protection zones*, NSW Rural Fire Service, November 2019, Standards APZlow.indd (nsw.gov.au)
5. *Planning for bush fire protection: A guide for councils, planners, fire authorities and developers, Appendix 1* and *Appendix 4*, NSW Rural Fire Service, November 2019, Planning for Bush Fire Protection 2019 (nsw.gov.au)
6. *Reducing bushfire threat with sensible garden design*, Alison Elvin 2022
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8. *10/50 vegetation clearing,* NSW Rural Fire Service, 10/50 vegetation clearing - NSW Rural Fire Service. The online tool can be found here Check if you're in a 10/50 area - NSW Rural Fire Service.
9. *Plant flammability experiments offer limited insight into vegetation–fire dynamics interactions*, Paulo M. Fernandes and Miguel G. Cruz, 2012
10. *Some fire retardant native plants for the Southern Highlands Region*, Geoff Butler, March 2020
11. *Fire retardant garden plants for the urban fringe and rural areas*, Tasmanian Fire Service

12. *Fire Retardant Plants for Canberra*, Yarralumla Nursery

13. *Local native plants suitable for planting or direct seeding in the Murrumbateman region*, Sue McIntyre, 2020, https://landcare.nsw.gov.au/groups/murrumbateman-landcare-group/copies-of-presentations/local-native-plants_sept-2020-1.pdf/view

14. *MLG community nursery order list – 2022-23*, Murrumbateman Landcare Group, MLG nursery order form 2022-23 Excel version — NSW Landcare Gateway

15. *Detailed information on flammability of plants suitable for our region,* Detailed information on flammability of plants suitable for our region — NSW Landcare Gateway

16. *Plant Selection Key,* Country Fire Authority, 2022, https://www.cfa.vic.gov.au/plan-prepare/plant-selection-key.

17. *Land Management Practices Associated with House Loss in Wildfires*, Philip Gibbons *et al*, 2012, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0029212

18. *Essential Bushfire Safety Tips,* Joan Webster, CSIRO Publishing, 2012.