Sustainable Landscapes

looking after the future

Reducing fire risk in gardens

Living with drought and living with fire is part of living like an Australian.

Frank Vanclay

Fire is both our friend and our foe. Fire keeps us warm, lights up the darkness and cooks our food. Fire occurs frequently as a result of lightning strikes and has been used for thousands of years in this country as a tool for hunting food and refreshing the landscape. Fire can also cause us terrible pain and loss, death and destruction.

While fire is a natural part of the Australian landscape with a fundamental role in sustaining many ecosystems, it can be difficult to live with. Living in one of the most fire prone environments on Earth, however, we have to find a balance. We need to protect life and property while allowing fire to carry out its ecological functions.

Every fire is different. The way a fire behaves depends on particular weather conditions, fuel type and level and the topography of the landscape. The impact of every fire is also different and is related to the type of fire, its intensity, seasonality, location and the interval between fires (known as the 'fire regime'). The natural interval between fires may range from one or two years to hundreds of years, depending on the location and the vegetation community.

Indigenous Australians learned to manage fire as a part of everyday life and they cared for their country with fire as a tool. European settlement altered the way fire was managed and resulted in changed frequencies, intensities and timing of fires. In southern Australia where the climate is becoming warmer and dryer, many communities face increasing risk from intense fire especially in the summer months.

Urban landscapes, including parks and gardens, can be planned and designed to minimise vulnerability and strengthen resistance to fire. Careful attention needs to be paid to design, plant selection, materials and products selection and the maintenance of our garden environments.

Our fire science knowledge has developed a lot in the last 40 years. The behaviour of fire in our landscape and the relationships between fire and plants, animals and human settlements are becoming better understood. Through understanding fire we can determine how best to manage our risk and create sustainable landscapes that are most likely to protect us and the communities around us.

Bushfire behaviour

The behaviour of a bushfire is determined by three main factors:

- Fuel: type, quantity, condition and arrangement (includes vegetation and other flammable material)
- Weather conditions: air temperature, relative humidity, wind speed and direction, atmospheric stability
- Topography: slope, aspect and elevation

In the South Australian environment north and west facing slopes are more frequently subject to bushfire than east or south facing slopes. The greatest danger usually occurs when a fire is driven by hot, dry Northerly or North Easterly winds or immediately after a South Westerly wind change.

As a general rule, ridgetops are more dangerous than gullies, while steep slopes are more dangerous than gentle slopes. This is because fires accelerate when burning uphill and move more slowly when burning downhill.

Dwellings surrounded by thick bushland face greater fire risk than areas where undergrowth is sparse. Locations to the South and East of large native parks or forests may be particularly hazardous as a fire can quickly gain momentum when driven by Northerly or North Easterly winds. Burning bark and leaves can form embers which can blow beyond the bush to start new fires. In such areas a wide fuel-reduced zone around dwellings is recommended. This may range from 20 metres to 40 metres on or above steep slopes.

Refer to Native Vegetation Management guidelines
www.cfs.sa.gov.au/site/bushfire/prepare/preparing_your_property_for_bushfire/native_vegetation_management.jsp

Fire ecology

Fire ecology is the study of fire and its interaction with the natural environment. Fire is a complex phenomenon because while it is important in the maintenance of ecosystem function and biodiversity, it can present significant management challenges. Fire is a natural event and many of our native plant and animal populations are adapted to cope with or even benefit from fire. A few even depend upon fire. Species and ecosystems that are not well adapted to fire or are already threatened are the most vulnerable during a bushfire event.

Plants have a number of ways of surviving fire. Underground roots, stems and tubers, from which plants can reshoot, are insulated by soil; examples include ferns, sedges and mallee trees. In plants such as sheoaks and banksias seeds may be protected within thick woody fruits or capsules which open after the fire has passed. Thick bark protects the buds of trees like stringybarks, while other plants will survive in protected places such as rocky areas and wet gullies.

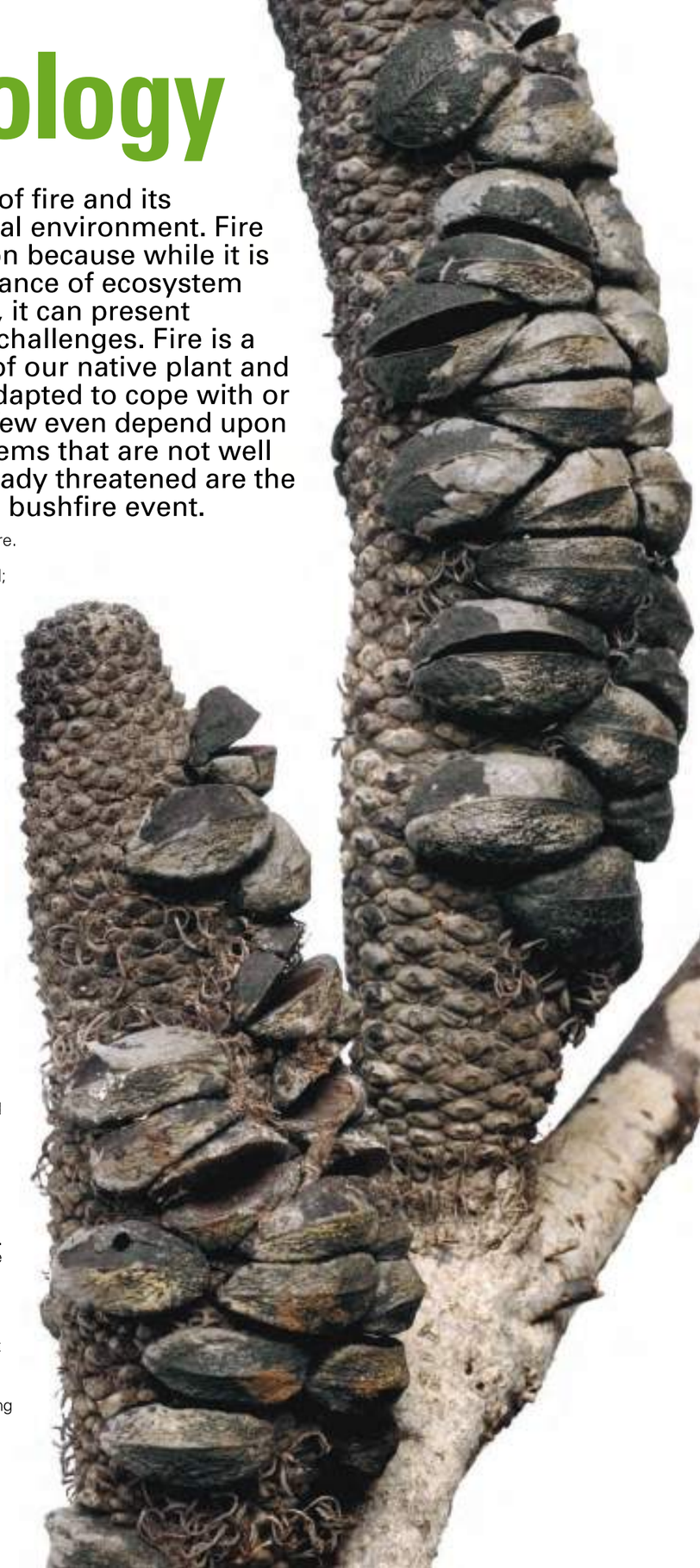
A number of smooth barked eucalypts store seed in nuts in the upper canopy and this seed is released after a fire. These trees may not survive a bushfire but through this mass release of their seeds the species is protected. Many species of wattle have developed hard coated seeds that are stored in soil, often buried by ants, and are cracked open by the heat of a fire which triggers germination.

Another survival mechanism is found in plants where growth is triggered by heat, smoke or the chemicals produced by fire as in sundews, kangaroo paws, flax lilies, native violets and guinea flowers. Fire also stimulates grass trees to produce their striking flower spikes which then provide food for a variety of wildlife including many small birds and butterflies.

A fire will often lead to a nutrient enriched environment where more light is available and competition is reduced, enabling seeds to germinate and thrive. After a fire many plants regenerate very quickly and animals return to take advantage of the seeds, resprouting vegetation, fungi, carcasses, burnt out logs and trees.

Animal species also respond differently to fires. Animals often survive bushfire by taking refuge underground or in patches of unburnt vegetation such as in damp gullies. While some individuals may die most populations do recover and some species even thrive in the improved quality of habitat that can result from a fire.

To assist in the recovery of native plants and animals after fire it is advisable to avoid disturbing the scorched soil and burnt logs that provide habitat, avoid introducing weeds and keep pets secured.



Landscaping to minimise fire risk

A carefully designed and well maintained garden can contribute significantly to a bushfire protection plan. The selection, location and maintenance of plants are all important.

Plant selection

- In general select plants with low flammability characteristics such as fleshy, moisture retaining leaves and foliage (note that plants with low flammability only maintain these qualities while they have access to sufficient moisture; any plant can burn when dry)
- Select tree species with low flammability characteristics and smooth bark (several native and exotic species have these characteristics)

Plant location

- Plants close to the dwelling should be low-growing, selected for low flammability characteristics and retain green foliage through summer such as lawn or low groundcovers
- Use plants with low flammability on the side of the building most likely to face an oncoming fire and on any steep slopes
- Plant tall trees away from the dwelling so branches do not overhang the roof and gutters do not fill up with debris
- Trees and shrubs should not be planted closer to buildings and powerlines than the distance equal to their mature height
- Ensure there is not a continuous canopy or line of vegetation from bushland to building
- Place well watered fruit trees and vegetables on the side most likely to face an approaching fire
- A windbreak some distance from buildings can help protect buildings from fire by reducing wind speed, slowing the spread of fire, filtering flying embers and providing a heat shield

Plant maintenance

- Undertake routine maintenance such as pruning, mowing, weeding and removing dead vegetation
- Provide plants with enough water to retain moisture in their foliage
- Keep lawns and grasses mown
- Maintain an area around buildings where there is no fuel for a fire; this means keeping the area clear of flammable plant litter, weeds and other flammable items

Litter hazards

Fuel load is one of the main factors that determine how a fire behaves. While the weather and topography cannot be controlled, the fuel load often can.

Fine fuels include leaves, twigs and dry grass that burn and produce heat rapidly. These fuels often accumulate in large quantities and can produce much of the radiant heat in a bushfire.

Heavier fuels consist of the trees, logs, branches and thick bark that burn more slowly than fine fuels. They can provide a continuous ladder of fuel, allowing fire to burn its way high into the trees and produce very large amounts of heat. Heavy fuels can burn for many hours or even days after a fire has passed.

Reduce fuel load around buildings and property by using sustainably sourced pebble and stone mulches rather than dry combustible materials such as leaf litter and pea straw.

Landscape design suggestions

- Create a buffer zone between any potential bush fire hazard and the dwelling; maintain a clear area around the dwelling with paving, groundcover or short lawn
- Position driveways, tennis courts and swimming pools on the side of the house most likely to be impacted by fire
- Use non-flammable mulches such as stone, pebble or gravel close to the dwelling
- Build a stone wall, earth mound or non-combustible fence close to the dwelling as a radiant heat shield
- Locate any woodpiles or timber stores away from the buildings
- Maintain clear access for fire fighting vehicles including wide gateways and well-compacted surfaces
- Ensure there is sufficient water available for fire fighting along with appropriate pumping facilities and hoses

Note: Building design should be guided by the Australian Standard (AS3959)
www.standards.org.au

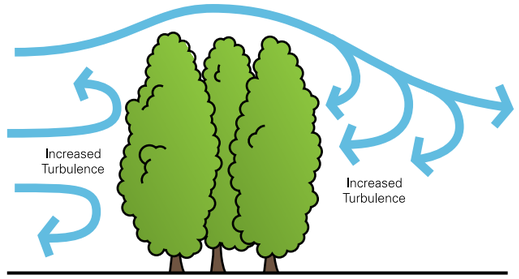
Windbreaks

Well managed vegetation can provide many benefits during a bushfire such as reducing the intensity of the fire, reducing wind speed, deflecting and filtering embers and providing a shield from radiant heat.

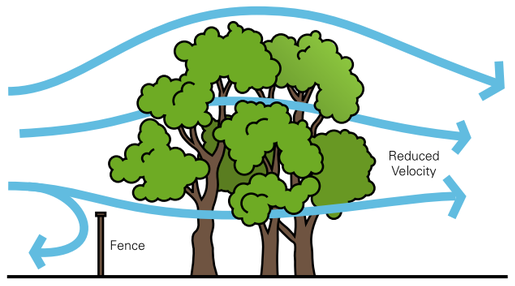
To make an effective windbreak:

- Locate on the side of the dwelling most likely to be impacted by bushfire and some distance from buildings
- Select fire resistant trees or shrubs
- Plant multiple rows of trees or shrubs
- Plant in an open pattern that reduces wind speed without causing turbulence

A number of plants can be used effectively in windbreaks, including exotics such as Poplars (*Populus* species) and Oaks (*Quercus* species), and Australian natives such as Blackwood (*Acacia melanoxylon*) and Lilly Pilly (*Acmena smithii*).



SOLID WINDBREAK



OPEN WINDBREAK

An open windbreak can catch sparks and reduce wind speed without causing turbulence.

Plants

Low flammability characteristics

The flammability of a plant is the combination of two key factors.

'The first is how readily its parts burn and the second is how the form of the whole of the growing plant influences the burning of the whole plant.'

Fire Resisting Garden Plants. Royal Tasmanian Botanical Gardens.
www.fire.tas.gov.au/userfiles/stuartp/file/FireResistingPlants2010.pdf

Some of the factors that can contribute to flammability include:

- ***Moisture content.*** *Most natives have a moisture content of 80 to 150% of their oven dry weight (ODW) while deciduous trees contain 250 to 400% of their ODW. The higher the moisture the slower the ignition. Lush, green material must be dried out by the fire before it will ignite.*
- ***Ash content,*** *or the solid matter left after burning. It tends to be made up of alkaline compounds that are naturally fire retarding , so low ash plants like Eucalypts (usually < 10% ash) will glow (and therefore can cause further flare ups) for longer periods than deciduous trees of 30 to 40% ash. This ash cools quickly and can smother remaining hot spots.*
- ***Volatile oil content.*** *In Eucalyptus, Melaleuca, Callistemon and other Myrtaceae the range of up to 5% oil is generally higher than other plants. When heated this oil can explode, intensifying the heat ahead of the fire front. This in turn heats and ignites more volatile oils.*
- ***Ignition temperature.*** *Plants with higher oil levels tend to have lower ignition temperatures, the Myrtaceae family ignite at 80 to 100 degrees C so they burn with less preheating than other species which ignite at 200 to 400 degrees C. Loose, flaky or rough bark will trap embers. This can produce enough heat for ignition.*
- ***Salt content*** *is more related to location than to species. Plants growing in saline conditions will have a higher salt content and this retards burning.*

The Permacultivator - Journal of Cool Climate Permaculture
www.permaculturesouthernhighlands.info/journal/bushfire.htm

Characteristics of plants with low flammability:

- High moisture content
- High salt content
- Broad fleshy leaves
- Low and dense habit
- Do not retain dead material
- Smooth trunks rather than rough bark

Plants with low flammability

All plants can burn under the right conditions. Plants with low flammability characteristics need to be grown and maintained to their optimum condition. Plants that are not healthy or are not maintained are likely to become susceptible to fire.

Botanic Name	*Common Name*	*Type*
Ground Cover		
Ajuga australis	Bugle Flower	Native
Carpobrotus glaucescens, C. rossii ●	Pigface	Native
Einadia nutans ●	Nodding Saltbush	Native
Kennedia prostrata	Running Postman	Native
Myoporum parvifolium ●	Creeping Boobialla	Native
Scaevola aemula, S. albida	Fan Flower	Native
Viola hederacea	Native Violet	Native
Rosmarinus officinalis (prostrate form)	Rosemary	Exotic
Low Shrub		
Atriplex species ●	Saltbush	Native
Correa alba	Native Fuchsia	Native
Correa reflexa	Native Fuchsia	Native
Enchylaena tomentosa var. *tomentosa* ●	Ruby Saltbush	Native
Maireana brevifolia ●	Short-leaf Bluebush	Native
Maireana sedifolia ●	Pearl Bluebush	Native
Rhagodia species ●		Native
Choisya ternata	Mock Orange	Exotic
Hebe species ○		Exotic
Pelargonium species	Pelargonium/Geranium	Exotic
Sedum species	Stonecrop	Exotic
Medium Shrub		
Acacia acinacea	Gold Dust Wattle	Native
Myoporum insulare ●	Common Boobialla	Native
Chaenomeles japonica ○	Flowering Quince	Exotic
Magnolia grandiflora ○ 'Little Gem'	Magnolia 'Little Gem'	Exotic
Small Tree		
Acacia decurrens	Early Black-wattle	Native
Acacia vestita	Hairy Wattle	Native
Camellia cultivars ○	Camellia	Native
Hymenosporum flavum	Native Frangipani	Native
Malus species ○●	Apple	Exotic
Morus species ○●	Mulberry	Exotic
Prunus species ○●	Stone fruit	Exotic
Pyrus species	Ornamental pears	Exotic
Tall Tree		
Acacia melanoxylon	Blackwood	Native
Melia azedarach var. *australasica* ●	White Cedar	Native
Ceratonia siliqua ●	Carob	Exotic
Fraxinus species ● (not Desert Ash)	Ash	Exotic
Liquidambar styraciflua	Liquidambar	Exotic
Magnolia grandiflora ○	Magnolia	Exotic
Quercus species ●	Oak	Exotic
Ulmus species ●	Elm	Exotic
Grass or Sedge		
Dianella species	Flax Lily	Native
Lomandra species	Matt Rush	Native
Cymbopogon citratus	Lemon Grass	Exotic
Climber		
Hardenbergia violacea	Native Wisteria	Native
Lawn Grass		
Zoysia macrantha *	Manila Grass	Native
Bothriochloa macra *	Red-leg Grass	Native
Stenotaphrum secundatum 'Sir Walter'	Sir Walter Buffalo	Exotic

When using plants not indigenous to your area, please check for weed potential.

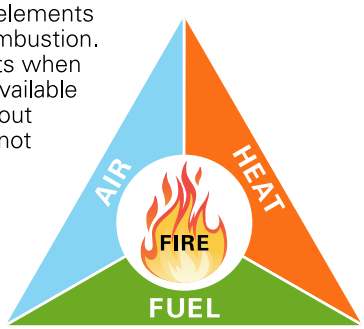
* *Warm season perennial native grasses, when kept mown, can be used as low flammability lawn species.*

○ *Depending on species and local conditions, this plant may require additional water to maintain optimum health.*

● *Under optimum growing conditions and depending on the intensity of the fire these plants have qualities that make them more resistant to fire.*

What makes a fire?

Heat, **Fuel** and **Oxygen** are the three elements required to ignite fuel and maintain combustion. Fire is the chemical reaction that results when these combine and all three must be available for the reaction to be successful. Without sufficient **Heat** and **Oxygen** a fire will not start. Without **Fuel** and **Oxygen** a fire cannot continue. Depending upon the material being burnt, removing or suppressing any of these elements can retard or extinguish the combustion. This is the basic principle behind any fire safety or control.



References & useful resources

Landscapes Alive Plant Selector
www.environment.sa.gov.au/plantselector

CFS SA
www.cfs.sa.gov.au

Department of Environment and Natural Resources - Fire Management
www.environment.sa.gov.au/fire

Australian Plant Society
www.apsvic.org.au/plant_fire_resistant.html

Design and Siting Guidelines CFA Vic
www.cfa.vic.gov.au/firesafety/buildingandregulations/documents/design_and_siting_guidelines1990.pdf

Planting Trees for Living Firebreaks
www.smalltreefarm.com.au/about-retardants.pdf
www.smalltreefarm.com.au/Case%20Studies.pdf

Barossa Bushgardens "Firewise" demonstration garden
www.barossa.sa.gov.au/site/page.cfm?u=472

Native Grass Resources Group Inc
www.nativegrassgroup.asn.au/pubs.html

Heyne's Garden Centre
www.heyne.com.au/gardencentre/factsheets/factsheet.php/Fire+Retardants.htm

Global Gardening - Gardening for bushfire protection.
www.global-garden.com.au/backissue2/gardenfeature2.htm

Fire Resisting Garden Plants - Royal Tasmanian Botanical Gardens.
www.fire.tas.gov.au/userfiles/stuartp/file/FireResistingPlants2010.pdf

The Permacultivator - Journal of Cool Climate Permaculture
www.permaculturesouthernhighlands.info/journal/bushfire.htm

Fires, gardens and fire retardant plants - a bibliography
www.anbg.gov.au/bibliography/fire-plants.html

Fire ecology
www.dse.vic.gov.au/fireecology

Building construction - Australian Standard (AS3959)
www.standards.org.au

Planning SA Building in Bushfire Prone Areas
www.planning.sa.gov.au/go/bushfire-protection

Permits

Permits and conditions for burning off and other purposes must be obtained from your local council fire prevention officer or call the Bushfire Information Hotline on 1300 362 361

Country Fire Service, Level 7, 60 Waymouth Street, Adelaide, SA 5000
www.cfs.sa.gov.au

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The Sustainable Landscapes project is a collaborative partnership between the Botanic Gardens of Adelaide (Department of Environment and Natural Resources), Land Management Corporation, Adelaide and Mount Lofty Ranges Natural Resource Management Board and SA Water.

The project demonstrates and promotes appropriate park and garden design, plant and material selections and sustainable horticultural practices for South Australian environments including effective, efficient and appropriate water use.

For more information contact

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www.environment.sa.gov.au/sustainablelandscapes

Landscapes Alive Plant Selector:
www.environment.sa.gov.au/plantselector

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Department of Environment and Natural Resources

Land Management Corporation

Adelaide and Mount Lofty Ranges Natural Resources Management Board

SA Water