Planting trees for Living Firebreaks

Introduction

The use of fire-retardant trees to landscape around the homestead can significantly increase the safety of buildings in the case of a wild fire event. Conversely having very flammable trees near to a house makes the risk of the building catching fire much greater. Effective living firebreaks require the choice of correct tree species and good grounds management.

Fire-retardant trees can protect from fire in three ways. Firstly, by acting as a shield against the immense radiant heat generated by an approaching fire, so that the house is protected from the intense temperatures that can shatter windows and melt materials. Secondly a large canopied tree, or a strategically placed hedge, acts to trap the burning material carried in the intense fire winds. This reduces the amount of flaming matter that can reach and ignite the building itself. Finally the stored moisture in the leaves acts as all water does; it suppresses the fire's energy. Many times even a single tree has saved a house or shed. That's why fire-retardant trees are living firebreaks.

Retardant vegetation can only ever be one element of a fire plan. It is not a magic cure-all. Nothing is guaranteed with wildfire but every little bit may help and a living firebreak stands ever ready to be of some help, regardless of whether anyone is present to fight the fire or whether everything else proceeds according to plan. At the very least it has to be better than surrounding yourself and your property with accelerant vegetation which force feeds the ferocity of a fire.

Which trees are fire-retardant?

The best trees for fire-retardant properties are those which have soft leaves with high moisture content, smooth and non-peeling barks, and low amounts of volatile oils in their foliage.

Generally speaking this includes the majority of deciduous trees and some evergreens from the sub-tropics and rain forests.

Please note:
Scaling trees for retardance is not an exact science.
Performance will vary with:

Weather & fire conditions
Fire behaviour is notoriously fickle and the apparent performance of retardants can as a result sometimes appear confusing and contradictory. Obviously the hotter the fire the better it can overwhelm the retardant properties of a tree. Some trees that would perform admirably in mild fires may not be able to contribute significantly in a severe situation - and mild and severe conditions can occur in different parts of the same fire.

Physical state of the trees
Drought stressed trees with leaves that contain suboptimal moisture, or trees whose crowns have become thin because of drought induced leaf shedding, ill health or unsuitability to the site will not be able to perform as effectively as healthy trees.

Dead wood in older trees can burn whilst the foliage wont. This is more dangerous in species which have dense crowns that are leafy on the periphery but have a hidden mass of dead twiggy material in the centre. In this way Tagasaste and Wattles can be reasonably retardant in their young fast growing stage but lose effectiveness as they mature. In the same way Cypress and Ti-tree which start off dangerous enough become positively so as the old and dead material accumulates in their centres.

Please note also that there may be variation in performance within a grouping listed on the scale.

A Rough Scale

Best
(Retardants)

Most Deciduous Trees
including
Oaks Willows Poplars
Planes Liquidambar Ashes
and **Fruit Trees**
including
Apples & Pears Stone Fruit
Fig Mulberry

Cape Lilac Coprosma
Morton Bay Fig
Lilly Pilly
rainforest trees
Pepper Tree NZ Xmas Tree

Kurrajong Sheoak
“Ferny Leaved” Wattles
Tagasaste

Bottlebrush
Peppermint Ti-trees

Cypress
Pines
Eucalypts

(Accelerants)
Worst

Fire Retardant Plants

A fire retardant is a plant which actually retards the progress of the fire because the energy required to combust the foliage is greater than the energy released from that combustion. The net effect is for the fire to lose energy, to slow, to "cool".

Conversely accelerant vegetation contains volatile oils in its foliage and releases a lot of energy when it burns; increasing the ferocity of a fire enabling it to spread further and faster.

In between these extremes on the scale there are plants which burn without great release of heat. Such plants are often labelled as being retardants but this is done on the basis that they are not great accelerants rather than because they actually retard.

Ultimately, with enough energy input all plants will burn. There is nothing that is completely fail-safe but it is fair to say that there must always be a difference between having retardants rather than accelerants around dwelling spaces.

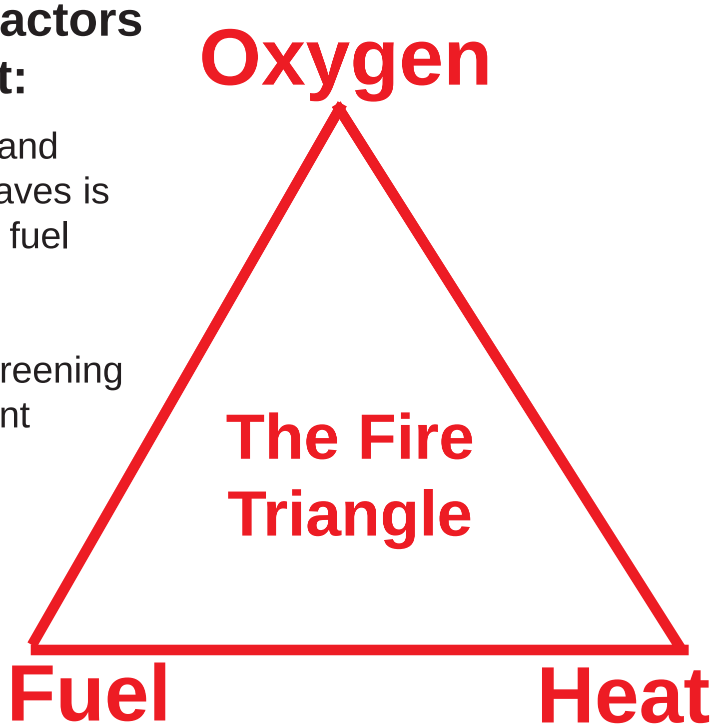
It will also be safe to say that the bigger and hotter the fire the less effective the retardant will be. In an extreme event such as Victoria's Black Saturday in 2009 the effect may be marginal, even academic, because so much heat energy is projected forward by the firestorm. In most fires however the difference could be significant, and, it might just make all the difference.

Fire retardants work by putting limitations on all of the three factors necessary for fire to exist:

- retardants do not provide ready **fuel** and where the combustion of their green leaves is not a net energy producer they may be fuel reducers.

- retardants can act as heat shields screening buildings and occupants from the radiant **heat** projected by the fire reducing the pre-heating which facilitates ignition.

- retardants can reduce or deflect firewinds denying the extra **oxygen** that can supercharge a fire.



In addition the screening foliage of retardants can trap flying embers causing them to die out harmlessly; and retardants typically create a cooler humid zone around themselves than do the accelerants.

The Flame Test

A rough idea of the fire safety of your garden plants can be gained by holding sample sprigs to a flame in safe conditions.

If they flare up immediately, especially at some distance from the flame, they are a real danger.The longer they take to ignite, and the less fiercely they burn, the safer they are..

Results should be interpreted with caution as this test cannot replicate actual wildfire conditions.

The moisture in green leaves of retardants needs to be first driven out so that they steam before they burn. This sucks energy out of the fire and slows its progress as opposed to the force feeding that occurs with accelerants. Steaming will cause browning of the leaf. It may appear that the tree has burned however browned leaves retained on a tree after fire indicate that steaming or scorching rather than burning occurred. Leaves that had actually burned would have been reduced to ash.

Fire Accelerant Vegetation

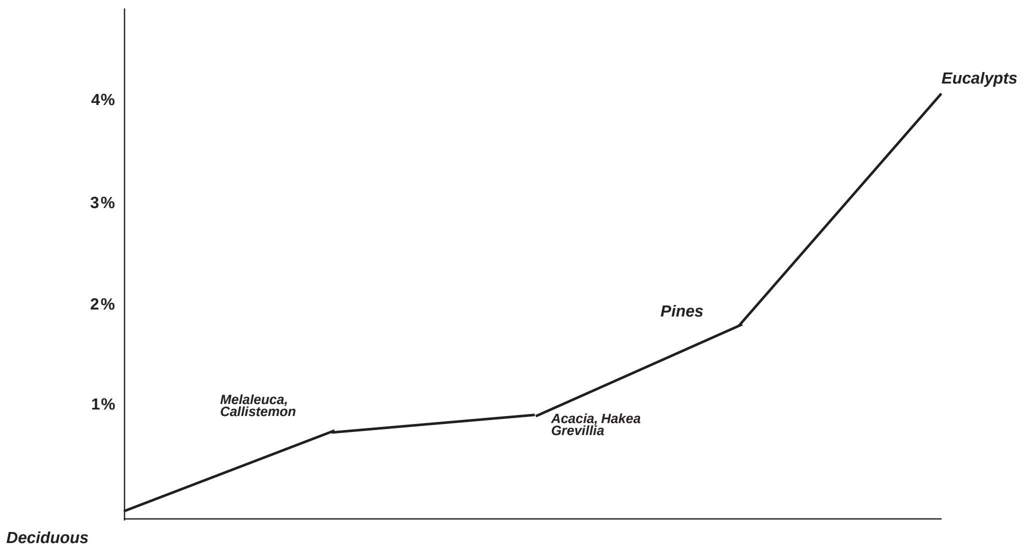
The foliage of accelerants contains a dangerous mix of a high volatile oil content combined with low moisture levels.

Gum Trees are unfortunately the most hazardous trees to have near your house. In fact some types will ignite at 60°C.

Pines and Cypress are only a little better. Many commonly planted native shrubs are also unsafe.

"Eucalypts seem designed to cultivate fire, as much as they are cultivated by it. The trees use fire to husband their own harvest and their features encourage its spread:
- fine leaves which ignite easily and burn fast and intensely;
- high oil content of leaves and twigs ready to vaporise;
-heavy litter fall (non decomposing leaves, bark, twigs and branches) in dry weather laying kindling beneath them;
-open-work canopies of hanging foliage which encourages updraughts during fire;
- and peeling bark readily whipped off by wind to start new fires wherever it lands." .

Joan Webster "The Complete Bushfire Safety Book "2000 p.3



Schematic representation of volatile oil content in the foliage of various tree and shrub groups. Eucalypts can have a volatile oil content over forty times higher than deciduous trees but half of the leaf moisture.

Ecology of Fire Accelerants

The ecology of eucalypts and pines has significant parallels. Both hold their seed in woody fruits high in the crown where it remains safe from fire. The heat causes the gumnuts or cones to dry out and release their seed a few days later onto a cooled ash bed where they can germinate in a competition free nutrient rich environment. Without recurrent fire both types will lose dominance on a site. Both are therefore inherently fire promoting through the volatile oils in their leaves. On a hot day the air can hang so heavy with the scent of eucalyptus or pine oil that an oppressive sense of potential fire develops. With good reason - things will burn better when hot air is supercharged with flammable oil.

The Hazard of Litter

Studies have shown that leaf and twig litter, especially twigs of pencil thickness, play an important role in initiating the combustion of buildings - often after the main fire front has passed through.

The “rain” of leaves, bark and twigs that falls from gum trees all summer long is a considerable hazard that needs regular clean up and disposal.

Eucalypts near dwelling spaces are a particular problem because they tend to shed some leaves gradually and continually over the summer months creating a constant and thankless chore. Such leaf shedding is worst in bad fire weather so that gutters can be refilled on a single hot, dry, windy day.

Gum leaves retain their flammable oil but not their moisture. As with Pines the litter can take many years to decompose. If not dealt with the hazard just keeps on accumulating.

The leaves of deciduous trees generally fall only during the autumn and rot down quickly without creating a significant fire hazard for the following summer.

Moisture stress can however cause deciduous trees to shed some leaves prematurely during summer months. The low flammable oil content means that these fallen leaves do not constitute a significant hazard but the effectiveness of the crowns in shielding from radiant heat and flying embers, and in deflecting firewinds, is reduced accordingly.

Some Eucalypt Species Are More Dangerous Than Others

Because fire will run easily from the ground up along the trunk and into the crown of roughbarked and stringybarked eucalypt species these two groups within the family are regarded as being more dangerous than the smooth barked gums.

Within the smooth barked range those types that shed their bark in long strips, some of which remain hanging in the tree awhile, are more dangerous those that shed in patches.

This has sometimes led smooth bark patch shedders, trees like the Spotted Gum and Snow Gum, to be labelled as fire retardant. Whilst they are clearly less dangerous than some of their cousins it is unfortunate to infer that they are actually safe. Their foliage is still quite flammable as is their litter.

Being Waterwise *and* Firewise

The need to use water wisely in the Australian environment has seen a shift towards native gardens. Whilst this an appropriate resonse in urban areas the older style exotic garden with a lawn is definitely safer in bushfire prone areas. For such situations it may be better to try to tweak the old style garden to try to achieve a firewise solution with the most efficient use of water possible.

Choosing species which are suited to the site rather than ones which look great in coffee table books but which come from far milder environments is very important, as is adjusting the scale of plantings to fit available water resources. Larger properties may have the potential for significant water harvesting and storage whilst in extreme cases a single strategically placed tree augmented by grey water maybe better than nothing.

Allocating water to ensure that an appropriately sized retardant zone is optimally resourced is, in effect, provision of fire fighting water. From a wholistic perspective that same water could also be seen to double as evaporative air conditioning and perhaps even a substitute for a swimming pool.

The apparent difference in water usage patterns of soft leaved deciduous trees and hard leaved natives is interesting.
Deciduous and rainforest trees seem to hang onto water as much as possible:
- high leaf density creates a mutually supportive humid zone which reduces transpiration,
- dense shade and soft mulch keeps the ground cool and better able to retain moisture.

The overall effect seems to be moisture hugging; a grim hanging on to water which maximises diurnal recirculation.

Eucalypts though seem to be spendthrifts which spray their water away into the air:
- wide spaced leaves enable easy air circulation which enhances evaporation,
- leaves that are usually turned edgewise to the sun to minimise water loss allow more of its energy through to dry out the litter layer.

Perhaps making an art form of living in a dry environment has led some eucalypts to focus on being able to survive with less water than on making the most of what they do have.

Water and fire are inimicable so it should perhaps not surprise that being waterwise and firewise should sometimes conflict. For example, mulching is a very useful and sensible water conservation technique but some of the most readily available materials - woodchips and shredded or composted bark - become a problem if ignited in a fire as they can become extremely difficult to extinguish, requiring recurrent attention to do so. Mulch can cause the loss of plants that would otherwise survive a passing fire. Non-flammable materials such as pebbles or gravel are to be preferred where fire presents a threat even if they are less practical or desirable. (Plastic underneath mulching materials can also create a hazard)

Burning mulch damaged this tree. Its mate escaped more or less unscathed.

The Park as Firebreak

Fire Services advise people who have built in or near bushland to clear or thin out a buffer zone around their house and to ensure that the crowns of any remaining trees do not touch each other, and that continuity between the crowns and ground vegetation is broken by pruning. This in ‘farm speak’ has been known as ‘parkland clearing’ and has its paralells in the English Park; the original meaning of the word ‘park’ being pastureland that is dotted with wide spaced, wide crowned trees.

Early english colonists were pleasantly surprised to find many such open grassed Parks scattered on fertile river flats through the forest country (and quickly occupied them). These had been cleared and maintained by the indigenous Australians around their regular campsites through regular low intensity burning; creating a comfortable fire safe living space which also fostered grazing for kangaroo.

The modern advice then follows time honoured Australian tradition. The result is even safer where the practice is refined by substituting fire retardant vegetation for accelerant in the inner zone that is close to buildings, in which case the stricture to keep canopies apart does not apply; when in fact the trees can be brought close together to better shield from heat, wind and ember.

Apart from heat and ember screening a ring of fire retardants appears to deflect winds around the house. Presumably the wind takes the easy way, the path of least resistance, taking the fire with it. Perhaps elevated humidity in the garden zone also plays a subtle part.

Deciduous trees may be killed an extremely bad fire but in most cases established trees with thick bark will survive a running fire provided that there is no extra foreign fuel around their base to provide extra heat.

Designing living firebreaks

Use of fire retardant vegetation is only one part of, but should fit within, the larger picture of design for bushfire safety.

Important considerations include topography; fire accelerates uphill putting hilltop sites at much greater risk that those nestled in a valley. A fire will double its rate of upwards spread for every 10 degrees of increase in slope but halve the rate of downwards spread for every 10 degrees that it is steeper. Prevailing wind directions are critical also. In south west WA the most likely directions for the wind to carry a fire are those to the east/north-east and the north-west to south-west. These two considerations of wind and slope will determine a lot about a site’s fire hazard and point to where living firebreaks should be concentrated. Other specifics that should be considered are the proximity of bushland or other eucalypt trees, plantations and dry grassy areas. Nearby recreation sites can also present risk; wild fire often starts as a camp fire.

Positives can include roads and gravel driveways, green lawns, water bodies including swimming pools, ponds or dams and established deciduous trees.

Good information about design is available from the various fire services and from “The Complete Bushfire Safety Book “ by Joan Webster (Random House Australia 2000) but remember that the advice given is general in nature and that in some ways principles may be different for retardant and accelerant vegetation.

For example it is usually advised that crowns of trees should not touch each other so as to slow the spread and intensity of fire. Very true for accelerants but with retardants a continuous canopy will be more effective in deflecting heat, wind and flame, as well as being better for intercepting embers. Also the concern that double row avenues of trees leading to the house may create a fire flume down the middle is less of a problem with retardants than it would be with eucalypts or pines.

This fire flowed downhill around the line of willows in the gully. However a wall of retardants at right angles to the direction of approach could prove very useful. The fire might hop over but would lose ferocity and be stalled in its advance as the planting would intercept heat and wind.

Good Management

The suggestions made here will not guarantee safety in a wild fire. They must be part of a complete fire planning system that includes building design, construction materials, availability of water to fight a fire and meeting of legal firebreak requirements.

Most important is ongoing diligence in managing the site. In relation to living vegetation this means that the garden must be well cared for to maximise the benefits of fire retardant vegetation. Not only trees but ground covers and shrubs should be selected with a view to their safety, and in particular, flammable bushes should never be planted under the eaves of a building. All dead wood should be pruned off fire retardant trees so they present only healthy living foliage.

Remember that in times of drought only the deeper rooted deciduous trees will maintain a high water content in their leaves. So if living firebreaks look drought stressed then some occasional trickle irrigation should be applied. If water is limited then the number of trees should be reduced, but strategically placed.

Weediness Potential

In Australia, apart from rainforest areas, the local native vegetation tends to be either on the very dangerous end, or towards the middle, of the accelerant - retardant scale. It follows that any retardant vegetation used will be exotic and that those best suited to grow on the site may, because of that very suitability, have the potential to become weedy.

Weed potential needs to be looked at in context. Woody weeds are generally easier to control than annuals because it takes years rather than months for them to set seed, and their large size makes it difficult for them to hide from the controller. The key words here are *the controller.* Most outbreaks of woody weeds have in the past been allowed to develop unhindered for decades. Provided that a boundary is established beyond which any volunteers from retardant plantings are actually controlled it should not necessarily be inappropriate to use the best retardant species for the job. Ironically, it is often the non local, therefore ‘exotic’ Australian trees that make the worst weeds rather than the off-shore exotics.