WILDFIRE, TREE MANAGEMENT AND THE ARBORIST

3 Tree Management and Wildfire

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INTRODUCTION

As a consequence of the Black Saturday fires in Victoria, Australia, there have been questions asked about the role of vegetation in peri-urban and urban parts of Australian cities. There was a Royal Commission (the highest level of parliamentary and legal inquiry available under Australian and British law) investigation into the Victorian fires (Anon 2010) and there has been huge public interest in the role that vegetation played in the spread of fire and the loss of life and property.

A spotlight has been thrust upon urban and per-urban vegetation management, with trees bearing the brunt of the scrutiny. In Australia fire is part of the ecology of many plant communities; doing neither harm nor good; it is simply part of nature's cycle (Gill and Groves 1981). In such places, natural fires should be allowed to burn and in managing such areas; the inevitability of fire must be recognised. If people are to live within or adjacent to natural forest communities their homes must be properly constructed and appropriate fire prevention plans and techniques implemented, which will allow fires to burn without threatening property or lives. In urban areas, however, the emphasis has been on pre- and post-fire tree management, plant selection and the broader topics of landscape design and management. Once again the arborist has a vital role to play.

PRE-FIRE LANDSCAPE MANAGEMENT

In urban areas where the vegetation of streets, parks and gardens is often a mixture of native and exotic plants, wildfires present some interesting challenges. While all plants are flammable given the right conditions, some are fire resistant or retardant (Table 1). Some of the native trees are well-adapted to fire and survive; others may be killed but regenerate readily from seed. Many non-Australian exotic species, however, lack adaptations to fire and have to be managed if the landscape is to be re-established properly and quickly.

Table 1. Characteristics of fire retardant tree species (from Moore 2009)

There are no non-flammable trees, but low flammability plants have the following characteristics:
• Green foliage during the fire season • High leaf moisture and mineral salt content • Low levels of dead canopy material, especially bark • Capacity to compete with and suppress grasses and understorey species • Capacity to survive droughts and occasional fires

In planning and managing landscapes from a fire perspective it is important to consider the use of fire resistant and retardant species. Lists of suitable tree species often contain few species and even fewer Australian native trees. They have to be used with considerable caution as there are rarely good data to support either listing or not listing species, and it is seldom emphasised that species must be appropriate to that part of Australia for which they are intended, otherwise there may be weed and hybridising problems (Table 2).

Interestingly, there has been huge interest in the use of deciduous, exotic trees, such as *Ulmus, Quercus, Acer Platanus* and *Liquidamber* species after the 2009 fires as they were seen to have survived and were not regarded as having facilitated the spread of fire (Figure 1). Many of these exotics do have attributes listed in Table 1 but many Australians are unaware that some of these species burn in wildfires in their countries of origin. However, as exotics growing in parks gardens and along roadsides they are usually deadwooded, pruned and their litter is collected regularly, all of which reduce the impact of fire.

Table 2. A selected and indicative list of some fire resistant and retardant Australian Native and Exotic tree species (modified from Moore 2009, Cheney 1985, Anon 1980)

SOME SELECTED FIRE RESISTANT AND RETARDANT NATIVE SPECIES		
Acacia bailyana,	*A howitii*	*A mearnsii,*
A dealbata	*Angophora* species	*Atriplex nummularia*
A vesicaria	*Casuarina* species	*Myoporum* species
Rhagodia baccata	*R nutans*	*Banksia marginata*
Banksia integrifolia	*Hymenosporum flavum*	*Lophostemon confertus*
Eucalyptus bauerana	*E gummifera*	*E leucoxylon*
E cladocalyx	*E blakelyi*	*Agonis flexuosa*
Corymbia maculata	*Melia azedarach*	*Melaleuca armillaris*
Tristaniopsis laurina	*Grevillea rosmarinifolia*	*Brachychiton species*
Syzygium australe	*Elaeocarpus species*	*Pomaderris species*
Bedfordia species	*Ficus macrophylla*	*Lagunaria patersonii*
Pittosporum undulatum	*Solanum aviculare*	*Hakea salicifolia*
SOME SELECTED FIRE RESISTANT AND RETARDANT EXOTIC SPECIES		
Acer negundo	*Acer campestre*	*Malus species*
Prunus species	*Arbutus species*	*Pyrus calleryana*
Magnolia Grandiflora	*Linden species*	*Quercus canariensis*
Cercis siliquastrum	*Ulmus species*	*Liquidamber styraciflua*
Populus species	*Camellia species*	*Photinia glabra*
Quercus species	*Sorbus aucuparia*	*Delonix regia*
Ligustrum lucidum	*Citrus species*	*Aesculus hippocastanum*
Note: Where a genus is listed, there may be many species which are fire retardant, but the most appropriate species within the genus are those that best meet the criteria listed in Table 1.		

Figure 1. Rapid recovery of horse chestnut, *Aesculus hippocastanum*, after wildfire where the fruits have protected the branch apices.

Vegetation can have many beneficial effects in terms of fire behaviour and fire management (Table 3). These benefits are often forgotten in the immediate aftermath of a fire, and in the frenzy of tree removals after fires the subsequent costs of vegetation removal can be quite significant. After the Black Saturday fires of 2009 some property owners were unable to rebuild because insurance companies deemed their land unstable once all the trees had been removed and the stumps ground. The risk of landslip was simply too high!

Table 3. Benefits provided by trees for a fire management regime

BENEFITS PROVIDED BY VEGETATION FOR FIRE MANAGEMENT
• Depending on tree density, trees can reduce wind speeds, slowing the rate of spread of fire and allowing the possibility of better fire control • Depending on topography, trees can reduce swirling of the wind and so ease fire defense • Depending on topography and wind direction, trees may deflect fires, especially crown fires over the top of buildings • Some species smolder rather than burn • Canopies can act as spark or ember arresters and so reduce the spread of fire on properties and the fire risk to buildings through ember egress • Roots can stabilize and consolidate steep slopes considerably reducing the risk of land slippage • Presence of trees before and after fire provide all of the usual ecological services such as shade, humidification of the air, wind speed reduction, reduced erosion and diminished water run off among many others (Moore 2009a, Moore 1997)

Trees often slow the speed of the fire front and if appropriately planted can reduce wind gusts and control the direction of wind, all of which can aid firefighting. The role of tree canopies in acting as spark arresters is also important in reducing the spread of fire and the egress of embers into homes and sheds. Many tree species that will be killed by a fire are very effective spark arresters, and can be incorporated into landscape designs with this function in mind even though it is known that they will die when burnt.

However, there are risks associated with vegetation and wildfires especially near homes (Figure 2) and particularly in the more densely populated peri-urban and urban sections of cites (Table 4). Through their shedding processes, trees contribute to the development of a litter layer, which is often referred to as the fine fuel load in Australia. Fine fuel loads in the vicinity of buildings must be managed through raking, use of low growing species such as lawns, and by keeping mulch moist thereby reducing its flammability.

Figure 2. Conifers near a home left standing after a wildfire. Four months after the fire they have started to collapse and must be removed at the owner's expense.

The management of litter and especially that which contributes to the fine fuel load has been a recommended goal of fire management near buildings for over 40 years. However, it does not necessarily mean the elimination of trees and vegetation. Hollow trees are great habitat trees and should be preserved where possible but when they occur near buildings in a fire prone place they should be removed as they burn hotter and throw sparks further than intact trees. Trees with all or major portions of their canopies dead must be managed as they not only provide fuel for the fire but present a falling hazard during the fire event, which is not only dangerous to life and limb, but can also makes fighting the fire more difficult.

Table 4. Risks associated with fire and vegetation to be considered as part of management plans (Modified and extended from Cheney 1985)

RISKS ASSOCIATED WITH FIRE AND VEGETATION
• Trees growing near power lines may clash with conductors and increase fire risk • Litter from trees can accumulate and so increase fuel load. However, this can usually be managed through proper fire planning such as raking and composting of litter. • Trees with fibrous bark may exhibit firebrand behaviour that can lead to spot fires many kilometres ahead of a fire. • Hollow trees can provide a chimney affect that throw sparks and which can make firefighting difficult and dangerous. • Damaged and dead trees may fall or become dangerous during and immediately after fires. • Fine fuels within 20m of a house pose a risk. An area that is free from flammable fuels may be achieved with lawn, paving, gravel, low flammability plants and/or raking to minimize litter and fuel accumulation. • Stringy barked trees close to the house can cause a risk of fire brands and embers landing on the house. They can be replaced with smooth-barked, evergreen, fire-retardant species. • Fuel near buildings puts them at risk. Regularly manage fuel reduction through raking and proper garden design and management, making use of fire retardant species. • Ember attack and egress are major threat to homes, which should be properly designed to cope with fire and to deal with embers that might attack of the property. • House materials may catch fire so housing in fire prone areas must be capable of coping with fires and high temperatures.

Overhead power lines have long provided a fire risk in terms of the possibility of tree trunks and limbs clashing with conductors and molten metal falling to the ground and starting fires. Indeed electrical conductors have been implicated as a cause of fires such as those of Ash Wednesday in 1985 and in at least one of the Black Saturday fires of 2009. The undergrounding of such services could virtually eliminate such fire risk situations.

TREE RELATED RECOMMENDATIONS FROM THE LEGAL REVIEW

The Royal Commission recommended that power lines should be placed underground (Anon 2010), primarily to reduce the risk of fire from clashing, but it would also reduce risks when fires occurred and in the subsequent mopping up. This has proved to be a contentious recommendation because while many believe that it is required in bush fire prone parts of the State, its multi-billion dollar cost has been emphasized. There have been claims that undergrounding the system would add 20% to electricity bills for the next 20 years.

However, the debate over this recommendation has been distorted. Few, if any, of the reduced economic costs captured by undergrounding have been factored into the debate to compensate for the higher installation costs (Table 5). Line clearing maintenance would be reduced, and in many places eliminated, and tree canopy development would be more substantial, providing for greater carbon sequestration and shade. This would result in greener, leafier suburbs and higher real estate values. There are very considerable economic benefits from the ecological and environmental services that urban trees provide. The removal of power poles would also reduce the risk of automobile accidents and their associated health costs.

Should power lines be placed under ground, it is logical that other utilities that use the above ground distribution infrastructure, such as communication and television cables should also be placed under ground. There is an important role for the arborist in minimizing root damage, and advising on boring techniques suitable for going under trees. Where there is rock or other legitimate reasons for not boring under trees then the arborist can advise on open trench techniques that again minimize root interference.

Table 5. Benefits that have economic benefit in offsetting the cost of undergrounding powerlines

ECONIMIC BENEFITS FROM UNDERGROUNDING POWERLINES
• lowered pruning and line clearing costs • lower long term infrastructure maintenance costs • higher ecological services values from trees with intact canopies that are left undisturbed • fewer pole and vehicle accidents and the associated savings in health and social costs • reduced damage and outages during storm events that are likely to be more common under a climate change regime • reduced cost associated with fires and the mopping up operations that accompany them • improved amenity values of streetscapes and higher of real estate values because of them • the higher value of a modern electricity distribution infrastructure which has to be replaced as it ages anyway

CONCLUSION

It is possible to have wonderful peri-urban and urban landscapes with all of the aesthetic, health and ecological benefits (Moore 1997) that they provide in fire prone parts of the world. Poor decisions in reaction to recent fires could have significant negative economic impacts and prove detrimental to human health and well-being.

Climate change will see a greater fire risk for much of Australia, with more extreme fire weather days, stronger winds from different directions and higher temperatures. At the same time however, the value of vegetation and trees in particular, especially in urban and peri-urban parts of cities, in reducing urban heat island effects and countering some of the temperature increases associated with climate change will be greater than in the past. Arborists have a significant role in contributing to urban tree management by reducing fire risk but at the same time securing benefits that contribute to the development of sustainable urban environments.

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