

## Nature's Renewal and the Rebirth of a Garden

by GREGORY MOORE

### Abstract

In Australia the term bushfire conjures up images of destruction, damage and even death. Like the Ash Wednesday fires, the recent fires in Sydney were seen as both devastating and catastrophic to both the natural environment and human life and property.

However, bushfires are not destructive in the natural environment. They are simply a part of the normal ecology, to which native plants and animals have adapted. Certainly, there will be individual plants and animals that are damaged or which die during a fire, but the populations and communities continue. Indeed, in many cases the communities that are known and loved by so many Australians are often dependent on fire, and without fire their future survival is jeopardised.

In gardens where there is often a mixture of native and exotic plants, bushfires present some interesting problems. Some of the native plants are often well adapted to the fire and survive; others may be killed but regenerate readily from seed. Many of the exotics, however, lack adaptations to fire and have to be managed if the garden is to be re-established properly and quickly.

Identification of the type of damage that individual plants have suffered, the characteristics of the fire and the adaptations of the plants must all be considered in determining whether specimens will live or die and how the garden is to be managed. Making a correct diagnosis of the plants condition after fire can save a great deal of money, time and effort in restoring a garden.

### Introduction

Following as it did, a prolonged period of drought, the summer of 1982/83 was particularly severe. Not only were temperatures high, but rainfall continued to be low. As a consequence, a number of natural and semi-natural communities were showing symptoms of serious drought, and the risks of fire were substantial. Throughout the summer there had been a number of serious fires, and it seemed likely that there would be fire damage to many plant communities.

Furthermore, as the summer progressed, the drought began to affect not only the natural communities but rural and then eventually urban communities. In Melbourne, as the gardens dried and then water restrictions were imposed, the effects on street trees, public gardens and domestic gardens became clear. The brown lawns that soon became evident were soon overshadowed by shrubs and then trees wilting, and in some instances subsequently dying. The drought was one of the most severe on record, and its effects on vegetation proved to be extensive and long lasting.

It is now a matter of record that the Ash Wednesday fires of 1983 were not only widespread but, sadly, destructive of property and human life. In the Macedon region, a taste of what was to come had already been experienced with the fires at Greendale and at Macedon itself earlier in the year. Although significant in their own right, these fires are often forgotten about, or are grouped with the Ash Wednesday

fire when the impact of fires on the region are considered.

The fires that affected the natural, semi-natural and created garden sites at Mount Macedon and its surrounds are worthy of review. The different sites responded to the fires in quite different ways, and the management implications of these responses are far reaching. The lessons to be learnt are quite profound and can be applied elsewhere, as the fires in the Sydney region of earlier this year demonstrated, and as the fires in New South Wales and Queensland this spring have also demonstrated.

### The effects of fire in the eucalypt forests of Mount Macedon

There is a considerable body of literature describing the role of fire and its effects on forests and other plant communities dominated by eucalypts (Gill and Groves, 1981; Groves, 1981). It is essential that the importance of fire as a natural ecological factor in such communities is recognised by all who live amongst the vegetation and who are responsible for its management. Eucalypt dominated communities are inevitably fire prone and fire dependent. It is impossible to have such communities without the periodic occurrence of fires and, conversely, the presence of such vegetation makes the occurrence of fire inevitable.

In general, eucalypts have a number of spectacular adaptations to stress and to fire in particular (Table 1). In the Macedon region, and indeed on the mountain itself, a number of different eucalypt dominated communities can be identified. The first is a tall open forest community dominated by species such as mountain ash (*Eucalyptus regnans*), and in some places associated with other species such as mountain grey gum (*E. cypellocarpa*) and mess-mate stringy bark (*E. obliqua*). In other places there were mixed eucalypt open forests with species such as *E. obliqua* and the peppermints, *E. radiata* and *E. dives* as dominants, and there were even a few remnant stands of snow gum (*E. pauciflora*).

These communities were all burnt during the fires of 1983, most on Ash Wednesday, but some in the earlier fires. The effects of the fires varied as did the communities' response. However, it is worth noting that in these natural communities, bushfires are not destructive, destroying or devastating but are rather the logical conclusion of one set of natural cycles, and the beginning of another. Without the fires these communities could not be what they are, they could not renew themselves and they could not continue. The fires clean up, recycle and renew the communities, and in every sense they rejuvenate the communities that have been burnt.

In the mountain ash dominated forests, the effects of fire were swift, sure and predictable (Groves, 1981). Individual mountain ash trees are very sensitive to fire and almost all were killed in this case. The trees killed can remain standing for many months and even many decades after the fire. It is usually assumed that regeneration in such communities' is from seed that is stored in the soil, and for some species such as many of the *Acacias* this is true. Indeed, a hot fire which damages the seed coat of the *Acacia* seed can be the trigger that allows germination. However, for the mountain ash and many other eucalypt species, there is virtually no seed in the soil or litter because the seed is

**Table 1:** Common Eucalypt adaptations to fire

Thick bark	Sclerophyllous leaves
Epicormic buds	Lignotubers
Woody fruits	Fibrous/stringy bark
Volatile oils in leaves	Seedling regeneration

harvested by insects, usually ants. Within four to six weeks of the fire, the fruits and foliage on the trees at the time of the fire are shed, providing both a nurturing mulch and a seed source for the regeneration that follows (Neville, 1986). In mature mountain ash forests there are few, if any, juvenile trees and the community can be described as even aged. Amongst the reasons for the lack of young trees, the competition from established trees and low levels of light are important factors limiting growth. Fire is the key to regeneration and continuity.

The fire affecting mountain ash trees, which lack many of the adaptations to fire of other eucalypt species, removes competition and allows high levels of light to reach the forest floor. Within weeks of the Ash Wednesday fires, the processes of renewal and regeneration were in evidence. Large 'toadstools' appeared which were the fruiting structures of the mycorrhizal fungi associated with the mountain ash roots. There was also significant litter, including seed scattered over the forest floor, and the ferns and tree ferns were already re-establishing their canopies and displaying a pristine new foliage.

In such a community it is best in many ways to leave the community to itself. Recovery will occur and is often complicated by human intervention. However, at a site like Mount Macedon it was not possible to leave dead and dying trees standing where they can present real hazards to life and property because of the high visitor traffic. Accordingly, some clean up operation was necessary, but as the effects are often long lasting and unpredictable, they should be kept to a minimum to allow for natural regeneration.

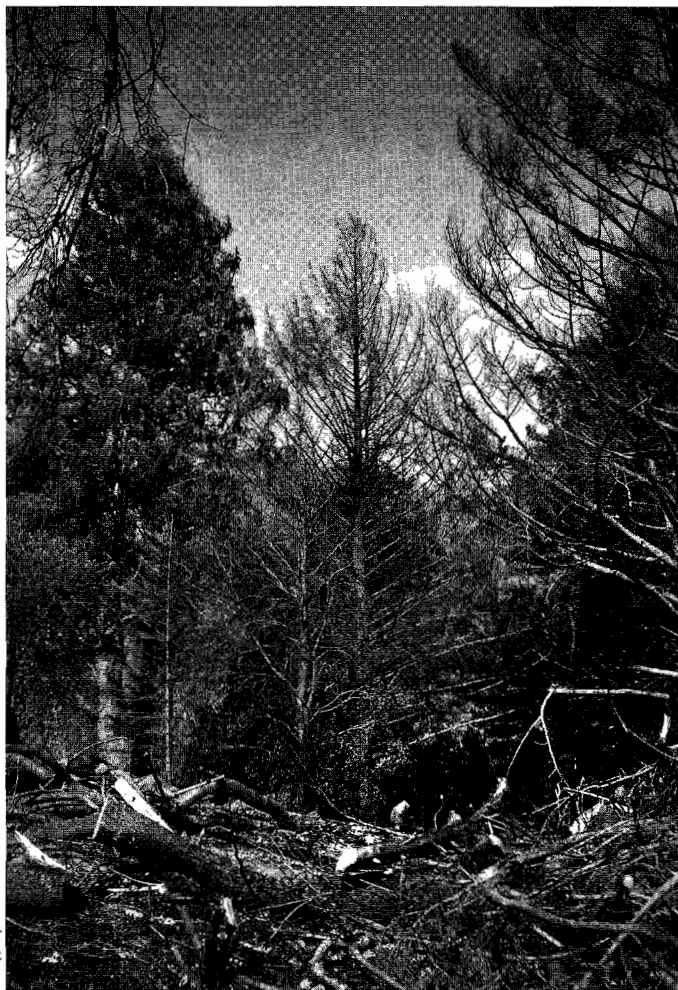
Similar events were taking place in the snow gum forests, where individual trees had been killed, but the processes of renewal, reseedling and regeneration were well underway. In the mixed forests of messmate and peppermint, regeneration not only involved the processes above, but many individual trees had survived the fire, and epicormic shoots and lignotuberous shoots were beginning to emerge as the communities commenced a new cycle of growth.

Much of the literature describing regeneration after fire, gives an impression of an even and generalised process of recovery. Such generalisations can be dangerously wrong, because they underestimate the impact of local topographic, environment and micro-climatic affects. In the Macedon region, recovery from the fire was much slower on northerly facing slopes (Lawton and Stockton, 1985). In some instances there was no seedling regeneration at all on such slopes, and the forest was re-established from lignotuberous and epicormic shoots. Clearly, aspect has a significant effect on recovery from fire, and must be considered in post-fire management (Parry-Burton and Foster, 1987).

Similarly, the effects of micro-climate on seedling germination and recovery after fire can be profound. Often the



*Epicormic shoots show the rapid recovery of this eucalypt five months after a fire*



Gregory Moore

Fire damaged conifers at Macedon, 25 March 1983

layer of black charcoal that is left behind after the fire, while it is nutrient rich, absorbs heat and so seedling germination and establishment may not occur for months after the fire. Accordingly, many species germinate in the 'nature's little greenhouses' that are provided by the fallen debris, logs and tree trunks that occur on the forest floor after fire (Neville, 1986; Parry-Burton and Foster, 1987). Removal of this debris, far from being good management, can reduce seedling germination and establishment, delay recovery and affect the composition of the community that re-establishes in the wake of the fire. Furthermore, the fallen logs, branches and tree trunks can also trap soil particles and other debris that is moved by heavy rainfall, and which can lead to erosion (Neville, 1986).

In these natural and semi-natural communities, fire cannot be seen as destructive or devastating, even though individuals die and valuable timber may be lost. These communities are fire dependent. Fire is part of their ecology and does neither harm nor good; it is simply part of nature's cycle. In such places natural fires should be allowed to take their course and, in managing such areas, the inevitability of fire must be recognised. If people are to live in such places their homes must be properly constructed and appropriate fire prevention plans and techniques implemented which will allow such fires to burn without threatening the property or lives of the people that live amongst them.

It is disappointing that in a place like Victoria, which is probably the most fire prone region on the planet, the

**Table 2:** Criteria for assessing plant condition

- Cracked and lifting bark
- Bark separated from cambium and sapwood
- Dead cambium (discoloured/dark brown)
- Ringbarked major branches or trunk
- Ringbarked trunk at soil or mulch surface
- Dead or seriously damaged roots
- Presence of dormant buds for recovery
- Presence of epicormic or lignotuberous buds
- Capacity for suckering

lessons of our fire history have not been better learned. In such forests, fire is not the enemy to be fought but rather an ecological factor that requires thoughtful, visionary and professional management. Victorians should be leading the world in such management, rather than looking for inappropriate lessons from elsewhere or repeating the mistakes of the past.

### The effects of fire on the gardens of the Macedon region

The effects of fire on created landscapes are often dramatically different from those in natural and semi-natural communities. The Macedon region has long been renowned for its spectacular and historic gardens and many of these also bore the brunt of fire in 1983. The burning of such historic garden sites raises many issues about post-fire management that had not been considered before. Much harm was done because people adopted immediate post-fire management practices that were applicable to forests rather than to major, substantial and historic gardens that housed valuable collections of exotic and native species.

In considering the effects of fire on gardens, it is essential to recognise what fire does to plant material. Some plants are burnt, some merely singed and others affected by the blasts of hot air that accompany the strong wind associated with bushfire. The effects on plants of burning, singeing and scorching are quite different, and must be managed in different ways after the fire. Furthermore, as always in dealing with biological systems, there is a strong variability amongst different genera and species. In short, you have to consider the characteristics of the plant to determine what its response to fire will be and how it should be managed.

It was interesting to be in Mount Macedon a few days after the fire and see the bulldozers piling ferns and tree ferns into great heaps on the assumption that they were fire sensitive and had been killed. In fact, the opposite is the case, and the growth habit of the tree ferns (*Cyathea australis*) and many of the ground ferns (*Polystichum sp.*, *Blechnum sp.*) is such that they are unlikely to burn and as a consequence are very fire resistant. The fibrous leaf bases, not only hold a great deal of moisture, but are slow to burn, and these characteristics provide ample protection for the growing apices within. The ferns in fact had suffered little damage in the fire. They had been defoliated, but would soon produce new fronds and show full recovery.

It is interesting to note that lessons had not been learnt from previous fires, such as the famous 1939 fires. In

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photos of the Warburton region taken immediately after the 1939 fires, which were of an intensity greater even than those of 1983, huge mountain ash trees had been reduced to a thin line of white ash on a velvet black background. However, the tree ferns though blackened and frondless where still standing and most recovered to be the mature, over-centurions that can be seen today in the regrowth forest. The ferns should never had been bulldozed in 1983, because the lessons of earlier fires were clear. The ferns are important because they contribute so much to the ambience and the texture of the landscapes, both natural and created in the Macedon region.

Mount Macedon has been renowned for the fine collection of conifers that its many gardens contained. It is usually assumed that conifers are very fire sensitive and as a consequence many trees were felled in the days immediately after the fires. However, not all conifers are killed by fires, and indeed some are renowned for their longevity and fire resistance. The thick bark of the redwoods renders them fire resistant, and usually they recover from fire quickly and well. Other species such as some of the deciduous conifers also cope well with fire. Often these trees are removed after fire unnecessarily and their removal can cause major impacts on the gardens they once dominated (May and Moore, 1983).

Given the significance of the conifers in the Macedon region, much greater care should have been given to those which were felled and those which were left standing immediately after the fire. A century old redwood is a very valuable specimen. As redwoods go, it is still in its infancy, but it can contribute much to the landscape after the fire because of its height, form and foliage texture. The thoughtless removal of conifers that have survived the fire literally squanders a century or more of time, effort, care and opportunity.

For other exotic plants, whether they are killed or survive the fire depends upon the nature of their injury and the habit and adaptations of the species. Many of the rhododendrons that were burnt in the fire were killed, but those that were scorched by hot wind blasts, although looking rather sorry, had suffered little more than defoliation and soon produced new leaves and shoots. In such a case, it is necessary to identify the type of injury and the fact that the cambial layers have not been damaged in determining how the species should be managed. By leaving scorched rhododendrons in place an important element of many historic gardens were soon restored. Once again, in the enthusiasm to clean up after the fire, viable rhododendrons were removed and this represents poor, rather than good management.

For many exotic plants, although the stems and foliage were killed in the fires, the root systems remained alive and active. In some cases, regeneration from the rootstocks is not only useful, but provides a rapid means of re-establishing valuable vegetation. However, caution must be exercised because for grafted exotics the rootstocks may not only be the wrong variety, but in some cases are different species that are not wanted in the garden context (May and Moore, 1983). This scenario is amply demonstrated in the recovery of rhododendrons and roses amongst other species. The opportunity for budding and grafting of preferred, or even new varieties on to these rootstocks was

often not even contemplated let alone tried in most gardens. It should be remembered that budding and grafting onto established rootstocks can provide an attractive and substantial specimen in a very short time.

Bulbous and cormous plants are often unaffected by fire, which has no real effect on their subsequent growth, apart from providing a boost in soil nutrient levels. Indeed, following the fires the displays of such plants in the following May through September was often quite spectacular, especially in the absence of so many other garden species. In talking about such plants it should be remembered that while there are many exotics of this type such as daffodils, freesias tulips and irises, there are also native species such as our orchids and the insectivorous droseras. For certain of the rhizomatous species, the effects are very similar and once again the fire has little impact upon their subsequent growth.

It is also worth noting that the adaptations described earlier for eucalypts (Table 1) are also possessed by many other species, both native and exotic. For example, the lily-pilly can possess a lignotuber, some species in elms possess epicormic buds, many species of shrubs and trees have thick bark, sclerophyllous leaves are possessed by many native and exotic species and, of course, many species possess woody, fire resistant fruits. In evaluating the chances of survival of these species, it is worth considering their adaptations and the likelihood of their survival.

### **The role of the horticulturist in post-fire management**

Immediately after a fire, it is important that professional horticultural advice is available to those responsible for managing the gardens that have been affected. It may seem to many that at such a time, when property and personal possessions have been lost, gardens would have a low priority. However, the experience at Macedon was quite the contrary. Many people had lost everything in the fire, but they had come to the Macedon region because of the environment and because of the gardens, and in many cases, the gardens were all they had left. In such cases, the gardens were a top priority and were symbolic of a commitment to the future, of regeneration and of a determination to rebuild.

Rarely in such circumstances is professional horticultural advice a part of the post-fire management strategy. Given the horticultural significance of the Macedon region, such a situation cannot be allowed to occur again. As part of the fire management plans for places such as Mount Macedon, the Dandenongs, or even the Blue Mountains region of Sydney, where there are large historic and significant gardens, there must be the availability of proper post-fire advice.

After a fire, it is essential that the horticulturist identify those plants that have survived and those which have succumbed to the fire (May and Moore, 1983). These decisions are sometimes difficult to make, but a number of simple criteria (Table 2) can be used to assess plant condition. It is important to determine whether the cambium has been damaged by the fire. This can be done on young tissue simply by peeling back the young bark and looking for the bright green cambium layer in some species or a nice light to pale brown cambial layer in others. Dark brown layers normally indicate that the plant is dead or dying. In older parts of the plant, especially for thick barked species, it



might be necessary to tap the bark to see if it has lifted from the cambium or to remove a small section of the bark to allow cambial inspection. If the cambium is dead, that part of the plant or the whole plant should be removed.

Another symptom that is worth looking for is the lifting of the bark from the cambium or the development of substantial cracks in the bark. Care has to be taken with species like the gum barked eucalypts that shed their bark in strips seasonally. However, when the bark lifts, it is often a sign that the cambium has been killed, and that the branches or trunks so affected have no prospect of recovery.

It is also necessary to establish whether the root system of trees and shrubs remain viable after the fire. Often trees and shrubs growing in well mulched garden beds were ringbarked by the intensity of the fire around the base of the trunk as the mulch burnt. In some cases, whilst the trunks and foliage appeared to be little damaged, the plant had been ringbarked and in many instances was doomed. In other cases, the fire or the burning mulch killed the lateral and feeding roots that are near the soil surface. In such cases recovery is often unlikely.

In assessing the affects of fire on any vegetation or plant community, it is essential to remember that there are two important constituents of the stress imposed by the fire. The first is the intensity of the fire, usually measured by its temperature, and secondly the duration over which the plants experience the effects of the fire (Moore, 1975). Frequently, plants can survive very high temperatures if the durations are very brief, but can be killed by less intense fires that burn for longer durations.

It is also important to realise that the fire can change the environment in which the plants grow. Removal of foliage and overstorey cover exposes plants in the understorey and at ground level to much higher levels of radiation, to stronger winds and to wider fluctuations in temperature. Sometimes, plants that have survived the fire succumb to a second dose of stress in the weeks and months that follow. In the Macedon region, after the 1983 fires, many plants suffered significant damage from the severe frosts and snow falls that occurred in the following winter (Lawton and Stockton, 1985). Previously, many of these plants would have been protected by the other plants growing around them.

The role of the horticulturist is significant. Not only can the fabric of a garden be saved after fire, which can substantially reduce the time for re-establishment, but economic factors can be addressed as well. Immediately after the fire, clearing up of dead or dying plant material is carried out by the emergency authorities without cost to the land owner. A quick diagnosis of whether plants are likely to survive or not means that a swift and economical clean up can be made. However, by delaying for some months after the fire, the clean up and removal costs are usually borne by the land owner and in some cases can amount to many thousands of dollars. After one fire, the estimated removal costs for a number of dead conifers exceeded \$50,000. As you can see, the financial stakes can indeed be high.

## Conclusion

It can be seen that the effects of fire on natural and semi-natural plant communities in the Macedon region are neither destructive nor devastating. Fire is part of the

natural ecological cycle of these communities, and without the fire the communities can neither regenerate nor persist through time. In such communities, fire is inevitable, usually on a periodic cycle and, as a consequence, fire must be properly managed in these regions.

Even in the exotic, grand and historic gardens of Mount Macedon, fire is not necessarily the totally destructive and devastating force that many believe. Properly managed, gardens can be re-established and regenerated speedily and effectively. Certainly, some specimens die and others are so severely damaged that their aesthetic value no longer merits their retention, but other specimens are barely affected and rapidly recover. Furthermore, the fire may be the stimulus for the revitalisation of an aged or senescing garden, and so provide an opportunity for new and innovative garden design and plantings. Great gardens are not static museum pieces but rather dynamic and evolving communities of plants. Fires are really just part of the change process, provided that they are anticipated, planned for and properly managed after the event.

The role of the horticulturist must not be ignored in the consideration of fire and its effects on regions like those in the Macedon district. A professional horticultural input into the pre- and post fire management of large, significant and historic gardens is essential if these gardens are to cope with fire, to recover quickly and continue to be part of the heritage of the nation. Too often in the past, fire has come unexpectedly and been poorly managed. The price of such poor management is high in such significant assets.

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