Victoria's tallest trees

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Summary

The heights of over 200 trees from more than 30 tall stands were measured between December 2000 and February 2002 in an attempt to determine the location of Victoria's tallest existing trees. For the first time in Australia, two relatively new methods for measuring tall trees, the ground-based laser rangefinder sine technique and a tapeline deployed by an arborist, were used to achieve a high degree of accuracy. The tallest tree was a 91.6 m (300.5 ft) *Eucalyptus regnans* (mountain ash) growing at 690 m asl in the Wallaby Creek catchment, Kinglake National Park. More than 50 trees were found to be taller than the previously recognised 'tallest tree' located in the Cumberland scenic reserve, which now stands at 81.5 m. All but one of these trees are *E. regnans*, the exception being an *E. nitens* (shining gum) 85 m tall growing in the O'Shannassy catchment of the Yarra Ranges National Park. All trees 85 m or more tall are well over 150 y old and have probably reached their greatest height. As senescence inevitably reduces their height over next 100 y, regrowth trees resulting from fires in 1908, 1923, 1926, 1932 and especially 1939 will progressively provide the tallest trees in the State. At present the tallest regrowth trees are located along Sassafras Creek in the Dandenong Ranges. The stand is less than 100 y old and the tallest tree reaches 84 m, with many others between 80 m and 83 m.

Keywords: veteran or remarkable trees; height; *Eucalyptus regnans*; Victoria

Introduction

Eucalyptus regnans, mountain ash, occurs in natural forest in the Australian States of Victoria and Tasmania. This tree is commonly recognised as the tallest hardwood in the world, and reaches heights greater than 90 m (Costermans 1983). In global terms it is currently surpassed in height only by two species of conifer, *Sequoia sempervirens* (coast redwood) and *Pseudotsuga menziesii* (Douglas-fir), and equalled by another, *Picea sitchensis* (sitka spruce). All three species occur in the temperate forests along the north-western coast of North America (Carder 1995; Grescoe 1997).

In physical appearance, a mature forest of mountain ash is an imposing sight, with giant straight trunks, creamy-white to pale green or grey, rising 30–60 m above a wet sclerophyll or rainforest understorey (Fig. 1). The tree has a 5–10 m stocking of fibrous brown bark at its often buttressed base; then the smooth cream to light grey gum-type bark above extends to the upper branches. Sometimes the first branches will not appear for 60 m up the trunk, and they are often draped with long peeled strips of annually-shed bark. Because the leaves hang vertically, the tree crown may appear unduly small in proportion to the size of the trunk, especially to a viewer directly below the crown.

There have been numerous references to Victoria's tall trees in scientific and forestry journals: for example, Pierce 1890; Caire 1905; Maiden 1907; Cornthwaite 1925; Hardy 1935; Simpfendorfer 1982 and Mace 1996. Quoted tree heights dating from the 1850s to the 1890s, however, including claims of trees 120 m in height, let alone 150 m, must be treated with some scepticism. Perhaps the most believable maximum height recorded for a mountain ash was 114 m for a tree felled in 1880 at Thorpdale, South Gippsland. This

Figure 1. Mature mountain ash forest, Wallaby Creek Catchment. Photo S. Sillet.

tree was measured both before and after felling by a qualified surveyor, George Cornthwaite. He writes that this tree, and two other very tall trees nearby 'were to a certain extent, freaks, standing 50 to 100 feet above the skyline' (Cornthwaite 1925).

In the twentieth century, the only reference to a mountain ash >100 m was for a fallen tree near Noogee. It was measured after the 1939 bushfires and found to be 103 m to its broken top; the diameter at the break was 4 inches (Griffiths 1992). Although the tree stood 10 m above any known tree at the time, it had been unmeasured and unknown before the 1939 blaze.

Whether trees much over 100 m tall ever existed remains unsubstantiated and is not the main focus of this report, but the above figures are mentioned because great heights for mountain ash recorded from the 1800s are still quoted in contemporary texts; for example, the Guinness Book of Records (e.g. McWhirter 1984) and Carder (1995).

After the devastating 1939 'Black Friday' bushfires, Victoria's tallest known trees were to be found in the Cumberland scenic reserve, 20 km north-east of Marysville. This stand of trees was set aside in the 1920s to preserve a 'sample acre' of tall trees. It originally contained 27 trees, the tallest of which was said to be 92 m, whilst the average height was 81 m. A severe wind storm in 1959 blew down 13 trees and left the 'tall tree' at a reduced 84 m (Munro 1992). An examination of the crown of this tree by arborist Tom Greenwood (Tom Greenwood *pers. comm.* 2001) suggested that it was unlikely that it ever reached the original figure of 92 m; the current height is 81.5 m, a figure used as the starting point for this search for Victoria's tallest tree.

Table 1. Regions with stands of tall trees

Region	Location of tall stands
Yarra Ranges	Acheron Way, Ada, Badger Creek, Big Tree Road, Britannia Creek, Cement Creek, Cumberland, Deep Creek headwaters, Kalatha, Kolbioke Track, Meyers Creek, Morleys Track, Mount St Leonard, Mount Monda, O'Shannassy, Watts River headwaters, Yellowdindi
Dandenong Ranges	Mechanics Reserve, Olinda Falls, Sassafras Creek, Sherbrooke Forest, William Ricketts Sanctuary
Otway Ranges	Big Tree Flora Reserve, Maits Rest, 1896 stand, Turtons Track, Waterfall Tracks
Strzelecki Ranges	Tarra Bulga, Gunyah Gunyah, Mt Worth
East Gippsland	Snowy NP, Errinundra, Goongerah
Mt Disappointment	Wallaby Creek headwaters (including Big Ash), Plenty River headwaters

Despite a small number of opportunistic records, there has been no systematic and comprehensive study of tall trees in Victoria's history, and no expansive field research since the trees in the Cumberland scenic reserve were measured in the 1920s. Following the recent report on Tasmania's tall trees (Hickey *et al*. 2000), this study was an attempt to locate and document the tallest trees in Victoria. It also aimed to provide insight into the likely location of very tall stands in the future by including in the survey promising regrowth stands >70 m tall.

Method

Prospective stands of tall eucalypts were selected by first identifying forest regions dominated by mountain ash and shining gum. Within these regions, potential stands were identified via their approximate age, aspect, altitude and local knowledge.

The main regions identified were the Yarra Ranges, Otway Ranges, Strzelecki Ranges, Mt Disappointment, Far East Gippsland and the Dandenong Ranges. Individual stands from these regions are listed in Table 1 and their locations are shown in Figure 2.

Measuring tree heights

New techniques for measuring tall trees were used in this study. Initially, a Bushnell '500 Yardage Pro' laser rangefinder was used in conjunction with a Suunto clinometer to estimate tree heights in all regions. The previously-used 'simple tan' method of measuring tall trees was discarded in favour of the 'sine' method (M. Taylor *pers. comm.* 2000; A. Goodwin, Forestry Tasmania, *pers. comm.* 2001). In order to measure the height of the tree from eye level to the top-most leaves or dead branch, a direct distance from the ground to the top was measured with the rangefinder, then the angle to the top was measured by the clinometer, and trigonometry was used to calculate the vertical height. The same technique was used to calculate the difference in height between ground level at the base of the tree and eye level. Ground level was determined as the average between the high and low points of ground at the base of the tree. The rangefinder was also used for a second check on potentially tall trees: it was fired from directly below the canopy at an angle of elevation of close to, or exactly, 90°. As many mature mountain ash have open irregular crowns, it was often possible to record the tallest leaves in this fashion from directly below, thereby confirming the height assessed from a distance. When trees of extreme height were found, that is those ≥88 m, an arborist climbed the tree and used a tape measure to get an accurate height figure; that is, to the nearest 10 cm. (Fig. 3). The arborist also was often able to locate taller or equally tall trees across the skyline of the forest canopy. The difference between the height estimated by laser and the arborist's direct tape drop never differed by more than ±75 cm and was usually within 30 cm, so the laser-estimated heights for trees that were not subsequently climbed can be considered to be accurate ±75 cm.

Determining tree age

Stand age in mountain ash forest is often directly related to fire history (Ashton 1976). Some of the younger stands are the result of fires recorded in 1896, 1908, 1918, 1923, 1926, 1932 and 1939, and thus information on stand age is relatively easy to obtain. Determining the age of older stands is, however, fraught with

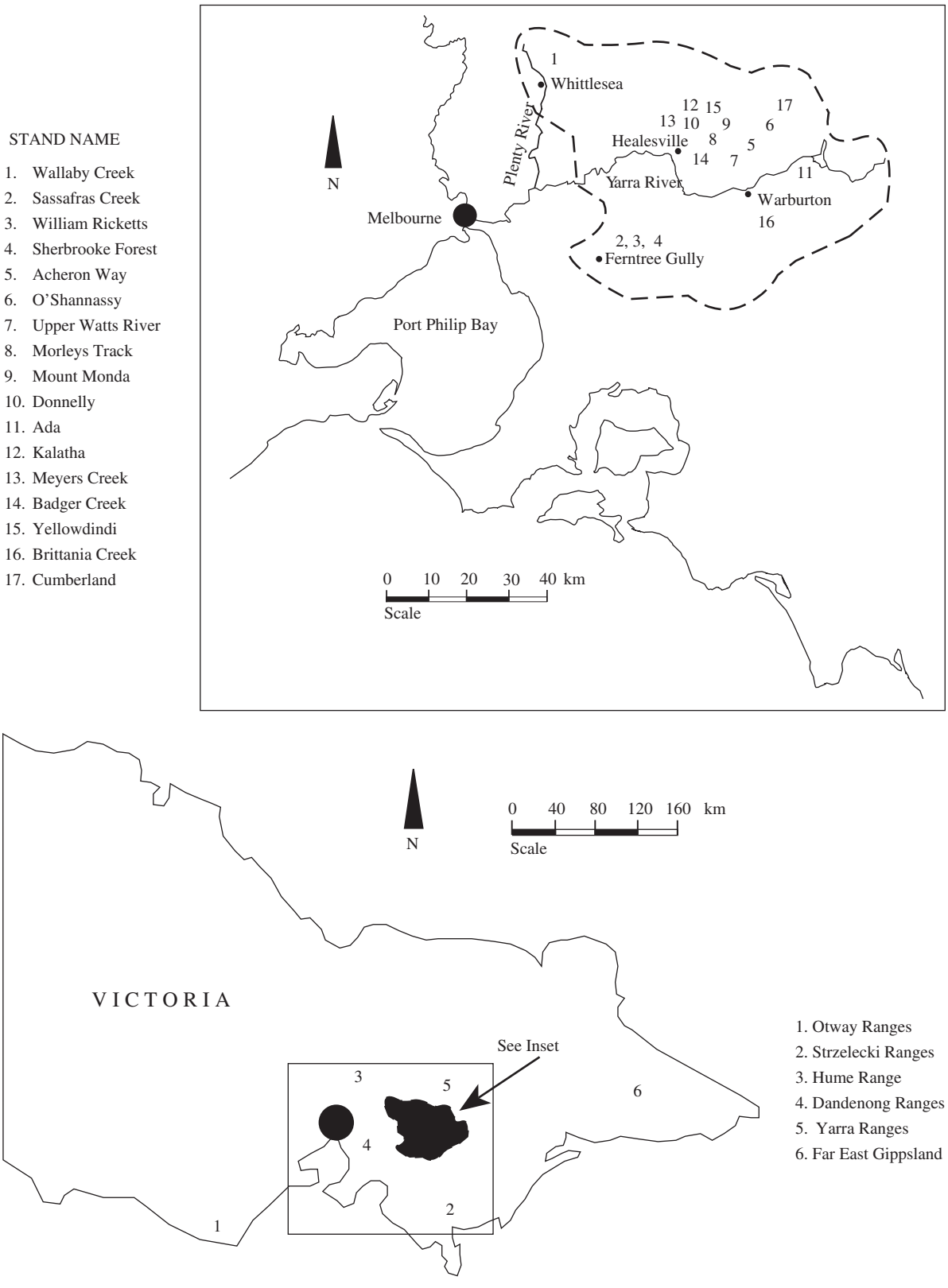

Figure 2. The main regions of tall trees in Victoria

difficulty, because of varied growth rates within a stand, and differing levels of disturbance over hundreds of years. Some previous work (Banks 1994) on old growth in the Watts River and the O'Shannassy catchments revealed ages of 459 y and 309 y respectively. Previous work in the Big Ash stand in the Wallaby Creek catchment showed that the oldest trees originated from a fire in about 1700, whilst another age class of trees began their life around 1851 (Ashton 1976). Within this stand now, however, it is difficult to tell, by purely visual means, to which age group an individual tree belongs, despite there being an age difference of around 150 y (D.H. Ashton, *pers. comm.* 2001). Therefore tree ages given beyond 150 y are approximate only.

Figure 3. Arborist Tom Greenwood climbing a mountain ash, 91 m tall, in the Wallaby Creek catchment. Photo B. Mifsud.

Tree growth stages

Forest stands can be described in terms of both age class and current condition. Stands in this study are classified according to the following categories (Jacobs 1955; Ashton 1976).

Spar-stage regrowth generally describes trees 60–100 y of age. The trees still have healthy conical crowns, and stand stocking is relatively high. Because this study focuses on trees taller than 81 m, very little regrowth has been included in the survey. However, promising stands with trees less than this height have been assessed. The stocking of spar-stage stands is in the range of 100–150 trees ha^{-1}. Examples include Morleys Track, Acheron Way and the 1926 Yellowdindi stand.

Early mature describes trees 100–150 y old. The crowns have begun to spread out and lose the apical dominance exhibited by the regrowth stage. Primary branches and the main trunk are increasing in diameter, and the stocking declines to 60–100 trees ha^{-1}. Examples include Turtons Track and the 1890 Barham River stand.

Mature describes trees 150–250 or even 300 y old. The trees have ceased height growth, and the stocking declines to 25–60 trees ha^{-1}. Most surviving trees are still relatively intact. Examples include the Big Ash stand at Wallaby creek, and parts of Upper Watts River.

Late mature describes trees 250–400 y old. Crown injury or dieback is common, and epicormic branching on the lower trunk can be a response to damage in the upper crown and increasing light as adjacent trees fall. Stocking is quite low, 10–25 trees ha^{-1}, increasing the incidence of wind injury to the tallest remaining trees. Examples include parts of the O'Shannassy, Cumberland and Mt Monda stands.

Senescent describes trees in the final stages of life, 400–500 y of age. The few remaining trees, often reduced to around 5 ha^{-1}, may have huge girths and are much reduced in height. Examples are found in the Ada and Maits Rest stands. Disease and major windstorms may also lead to premature senescence of a stand, as in the Cement Creek and Cumberland stands.

Results

The tallest tree found in the survey was a 91.6 m mountain ash in the Wallaby Creek catchment, closely followed by a 91.1 m tree growing nearby. The former is the tallest known tree in mainland Australia. Similarly, the forest in which it grows, the Big Ash, is the State's most impressive stand in terms of height. An area of around 100 ha not only contains the two tallest trees but a further 24 trees over 85 m. The O'Shannassy catchment also contained impressive trees, with three of 90 m or more being found. The 15 tallest trees found are listed in Table 2, while Table 3 ranks the stands on the basis of the tallest tree known within them.

In all, over 100 trees taller than 80 m were found, with at least 45 of these being greater than the 81.5 m Cumberland tall tree — previously recognised as the State's tallest. Most of the trees listed were recorded for the first time in this study. All of the trees over 85 m are mature, being at least 150 y old, and in most cases over 250 y old. The tallest trees found were all within closed water

catchments in the Kinglake and Yarra Ranges National Parks, and thus public access to them is restricted.

Discussion

Any study on tall trees can represent only a snapshot in time. Wind, crown dieback, disease and even heavy snowfalls can reduce the heights of the tallest trees, whilst bushfires can destroy whole stands. Regrowth mountain ash resulting from fires in 1918, 1922, 1926, 1932 and especially 1939 are still developing, and over the next 20–50 y a number of individuals from such stands are likely to replace some of the trees listed in Table 2.

The availability of a tree climber who could locate tall trees from a vantage point in the canopy, and the existence of laser rangefinders, have made the task of finding and measuring outstanding trees much simpler. Nevertheless the actual surveying of large areas of forest is still enormously time consuming, and one can never be sure that all candidate trees have been located. Hence it is quite possible there is an undiscovered tree ≥92 m somewhere in an unsurveyed area of forest.

A number of factors influence the height and growth rate of mountain ash. They are considered here, as they may be useful in identifying existing and future tall stands.

Factors influencing the growth of mountain ash

Fire history. Intense crown fire has a major role in both the destruction and the regeneration of even-aged stands of mountain ash (Ashton 1976). It is likely that very tall trees will exist only where there has been no crown fire for at least 100 y. Low-intensity ground fires, however, are a lesser threat to mature mountain ash forest: even if the understorey is destroyed and regenerated a number of times, mature trees can survive and most retain their full height (Ashton 2000).

Stand aspect. A stand's aspect can affect tree growth and health through factors such as soil depth, water availability, and exposure to fire and wind. In this study, very tall trees were found in three different topographic situations:

- the Wallaby Creek, Cumberland, O'Shannassy and some of the best Watts River stands are on gently sloping or flat ground, such as a broad plateau;
- the Sassafras Creek and William Rickets stands are on, or very close to, a streamside terrace;
- the three tallest O'Shannassy trees are on steep, protected, south-facing slopes.

Altitude. Whilst mountain ash is found at altitudes of 200–1100 m asl, the best growth seems to occur in the low to mid-altitude range of 300–700 m. At lower altitudes, the species is often limited by lower and less uniform rainfall, as well as poorer soil. At higher altitudes it is replaced by the related but smaller and more cold-tolerant alpine ash (*E. delegatensis*). In this study the tallest trees were found at 680–760 m asl, but evidence from 1926 and 1939 regrowth stands indicates that very tall trees in the future are likely be at 250–400 m asl.

Soil quality. The best stands of mountain ash occur on deep, relatively fertile loamy soil (Costermans 1983; Ashton 2000). Increased surface rock on slopes may have a deleterious effect on eventual tree size and height, and at the limit of its range, on shallower soils and exposed sites, mountain ash is out-competed by the more versatile messmate stringybark (*E. obliqua*) (Ashton 2000).

Wind. Probably the second most damaging force in mountain ash forest is a wind storm. For example, the Cumberland scenic reserve suffered much damage through wind storms in 1959 and 1973, losing over half the tall trees set aside in the 1920s and having all surviving trees shortened. The same storms affected the nearby O'Shannassy stands, where most trees exhibited some crown damage. Heavy snowfalls can also inflict damage to trees, with branches (and whole trees) collapsing under accumulated snow.

Tree stocking. Stocking has an important influence on height growth. During the first 50–60 y, when the tree is undergoing its major growth phase, competition for site resources is intense, resulting in rapid self thinning within a highly stocked, fire-regenerated stand. Sustained medium to high stocking ensures that trees continue to direct most of their energy to a vertical, not horizontal, search for light. In addition, a mature 90 m tree receives more valuable shelter when surrounded by other tall eucalypts than where it dominates, say, rainforest or regrowth 25 m tall. For example, the 91.6 m tree at Wallaby Creek is still closely surrounded by similarly-aged trees 80–87 m tall. Solitary, open grown mountain ash, in cleared agricultural land in the Yarra, Otway and Strzelecki ranges, and in bracken-land, exhibits a completely different growth habit, with the main trunk diffusing into many large branches at 5–10 m above the ground, and a crown spread of up to 25 m.

Stand age. Given that mountain ash reaches maturity sometime between 80 and 120 y, it can be anticipated that tall trees will be at least this age, reaching their greatest height between 100 and 200 y. In the absence of major disturbance, the trees will maintain near maximum height until they are 250–300 y of age. While trees over 150 y old produce annual growth of around 5–10 cm, it is not always cumulative, nor vertical in direction, and is often negated by minor storm and snow damage. Most trees 350–500 y old will have suffered major damage of some sort, as well as decay of the upper limbs and trunk. For this reason it is unlikely that extremely tall trees will be found in the oldest stands.

Insect attack. Sap-sucking and leaf-feeding insects can seriously damage a forest stand (Yen 2001). Major infestations of the psyllid *Cardiaspina bilbata* are now killing many trees and markedly reducing tree stocking in the Cement Creek and Marysville regions. These infestations were first reported from the Tanjil Bren district (Baw Baw Ranges) and have been spreading westward (D.H. Ashton *pers. comm.* 2001). In the early 1960s, severe infestations of the leaf-feeding stick insect, *Didymuria violescens*, occurred in mountain ash forests around Powelltown, again causing widespread defoliation. While individual trees die in these attacks, the stands can survive, and it is unclear how important defoliation is in the life cycle of *E. regnans* (Yen 2001).

Physiological limits. Very tall trees have to maintain continuity in their water column to a great height against the force of gravity. Tall mountain ash from the Wallaby Creek Big Ash site certainly

Table 2. Victoria's 15 tallest known trees; all are *Eucalyptus regnans*

Height (m)	Girth (m)	Location	Notes
91.6	8.6	Off Road 3, Wallaby Creek	Big broad-topped tree with healthy crown, growing in a stand unusually dense for 300-y-old trees; 60 m to first branch. Site altitude 680 m. Height confirmed by climber-deployed tapeline.
91.1	11.15	Off Road 3, Wallaby Creek	Altitude 670 m, age 300 y. Height confirmed by climber-deployed tapeline.
90.6	8.4	100 m west off Road 12, O'Shannassy, about 300 m down from Road 9	*E. regnans.* On a fairly steep slope. Height confirmed by climber-deployed tapeline 31/08/02.
90.4	8.7	120 m west off Road 12, O'Shannassy, 350 m down from Road 9	On steep slope 120 m south of 90.6 m tree. Height confirmed by climber-deployed tapeline 31/08/02.
90	7.5	Road 5, O'Shannassy, about 750 m past 7 km sign, 200 m up from deep creek	One of the few trees with an intact top. Possibly 250–300 y old. Altitude 700 m. Height confirmed by climber-deployed tapeline.
88.9	8.6	60 m west off Road 3, Wallaby Creek, 600 m down from Road 12	
87.8	9	Off Road 3, Wallaby Creek, 150 m north of 91.6 m tree	
87.5	10	East off Road 3, Wallaby Creek, 200 m south of 91.1 m tree	Forks into two at 30 m
87	7.5	Road 39, Maroondah, about 70 m from the end of the road	In a stand that is now in decline, age ≥250 y
87	9.2	Wallaby Creek, 60 m west off Road 12 about 1 km before the junction with Road 3	
87	8	Off Road 3, Wallaby Creek, 30 m from 91.6 m tree	
87	9	Off Road 12, Wallaby Creek, 130 m north of Mr Jessop tree	
87	8	Road 9, O'Shannassy, 2 km past Road 7, 400 m past deep creek	
87	12	Off Road 3, Wallaby Creek, 180° from 88.9 m tree	
86.5	8	Road 5, O'Shannassy, 100 m up from 90 m tree which is about 750 m past 7 km sign, 200 m up from deep creek	Multiple tops
86.5	8	Road 9, O'Shannassy, 2 km past Road 7, 400 m past deep creek	

Note: All trees were measured between January 2001 and August 2002.

develop xeromorphic features at heights greater than 70 m, evidenced by smaller xylem vessels, thicker cuticles and smaller leaves in the uppermost crown. This appears to indicate that even trees growing in ideal conditions will be limited by internal physiological constraints (D.H. Ashton *pers. comm.* 2001).

Disturbance. At the time of European settlement much of the mountain ash forest was in a mature phase, and very tall trees were widespread (Griffiths 1992). Large parts of the Strzelecki and Otway Ranges, now cleared, were covered with mountain ash forests. Griffiths (1992) estimated that as much as a quarter of all

Table 3. Stands containing tall trees (*Eucalyptus regnans* except those marked * which are *E. nitens*) ranked on the basis of the tallest tree known within each stand. In many cases the date of stand origin is only approximate. NP = National Park.

Stand location	Height (m) of tallest tree	Additional tall trees (m)	Stand origin and description	Tenure and access
Wallaby Creek	91.6	91.1, 88.9, 87.8, 87.5, 87, 87, 87, 86, 86, 86, 85.5, 85.5, 84.3, 84; many others are 80–83 m tall	1700 and 1851, mature	Water catchment area within Kinglake NP, closed to public
O'Shannassy	90.6	90.4, 90, 87, 87, 86, 85*, 85, 84, 83, 83, 82	1650 to 1750, mature to late mature	Water catchment area within Yarra Ranges NP, closed to public
Mt Monda	87	80, 78	1550 to 1700, mature to late mature	Water catchment area within Yarra Ranges NP, closed to public
Watts River	85.5	85, 84, 84, 83.5, 83, 82.5, 82.5, 82*	1851, mature	Water catchment area within Yarra Ranges NP, closed to public
Sassafras Creek	84	83.5, 83, 82.5, 82, 82, 81, 81	1900 to 1920, regrowth to early mature	Walking track through stand. Streamside reserve.
Donnelly Creek	83	79	1700, mature	Water catchment area within Yarra Ranges NP, closed to public
Sherbrooke Forest	83	76, 75	1922, 1905 and 1800, regrowth to mature	Numerous walking tracks (tallest tree well off track)
William Ricketts	82	80, 80, 80	1905 or 1922, early mature	Tallest trees visible from car park. Small creek-side reserve below sanctuary.
Cumberland Scenic Reserve	81.5	81, 78	1750, late mature	Walking track through reserve. Part of Yarra Ranges NP.
Yellowdindi	81	80	1926, regrowth	No track, State forest
Big Trees Flora Reserve	80.5	78.5	Around 1650	Special Reserve in West Barham catchment
Tarra Bulga	79	78, 76	1800 to 1850	National Park
Badger Creek	79		About 1850, mature	Track through Melbourne Water park
Kalatha	78		About 1700, late mature to senescent	No tracks but close to roads in State Forest
Britannia Creek	77	77	1932, regrowth	Some trees by roadside, in State Forest, others in DNRE plots
Olinda Falls	77	76	About 1900, early mature	Forms part of Dandenong Ranges NP. Trees visible from streamside track.
Acheron Way	76.7	74.9, 74	1939, regrowth	State Forest, no track
Morleys Track	76	76, 75, 74, 73, 73	1939, regrowth	Water catchment area within Yarra Ranges NP, trees visible from track
Otway 1896 stand	75		1896, early mature	Water catchment reserve, no walking track
Ada	72		1550 to 1650, senescent	Special reserve within State Forest. Walking track through stand.
Meyers Creek	72		1900, 1939, regrowth and early mature	Reserve, trees visible from road
Gunyah Gunyah	71		1920s to 1930s	Reserve

these forests has been cleared for agriculture, whilst another quarter has been destroyed by frequent fires. Most extant mountain ash stands have their origin in the major bushfires that have occurred at alarmingly frequent intervals in the past century.

It is not surprising that the two tallest trees are in a 100 ha patch of relatively intact 300-y-old trees in the Wallaby Creek catchment. Even this forest, however, has not entirely escaped disturbance. Paling splitters took a few choice specimens in the late 1800s and cattlemen used the forest for grazing before it was closed to the public — as part of Melbourne's water supply system (Ashton 2000). Crucially, however, the Big Ash somehow escaped the huge fires that have engulfed the Hume Range over the past 100 y, and thus most of the trees, including their all-important crowns (in respect to height) have remained intact. Perhaps, as a result of its avoidance of catastrophic major disturbances, the stand at Wallaby Creek can be considered typical of the finest forests that preceded European settlement.

Status of regrowth

Mountain ash and shining gum have the potential to grow very quickly, especially in their first 30–50 y. The Dept of Natural Resources and Environment (DNRE, now Dept of Sustainability and Environment, DSE) has studies of the growth of stands originating in 1918, 1926, 1932 and 1939[1]. The tallest 1939 mountain ash trees are already 76–77 m, whilst some 1926 regrowth is >80 m tall. There are many impressive trees, 80–84 m, in the Sassafras Creek stand, although it is uncertain whether these trees are from fires in the 1920s or at the turn of the 19th century.

Figure 4 illustrates the height growth of a number of the most vigorous trees in these stands. After 50 y, growth slows to less than 0.5 m y^{-1}, and it is predicted that these trees will reach a maximum height of around 85–92 m in the next 20–50 y.

Conservation of tall trees

All of Victoria's 20 tallest trees grow in designated water catchments enclosed within the Kinglake and Yarra Ranges National Parks, which are completely protected from logging. The tall trees of the Dandenong Ranges are similarly protected in public reserves. The promising 1926 Yellowdindi stand and the 1939 Acheron regrowth stand lie within State Forest and appear to have been afforded some protection, although many similar stands formerly in the DNRE study have already been logged. It is hoped that the most vigorous stands of regrowth trees, growing in ideal locations, will be left to develop to their full potential. Forestry Tasmania (2000) has a management strategy for tall trees which allows for the setting aside of areas of forest that contain trees ≥85 m, and of areas that have the potential to produce such tall trees. A similar strategy could be implemented in Victorian State Forest to ensure the long-term security of the best regrowth stands.

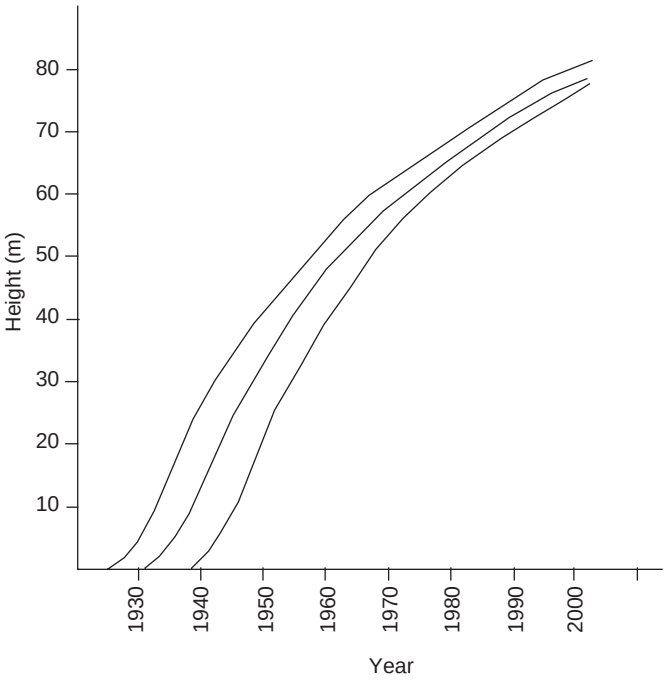

Figure 4. The time course of height growth of the tallest 1926, 1932 and 1939 regrowth mountain ash

Public access

Public access to trees ≥85 m is extremely limited because of their location in closed water catchments. Excellent examples of tall mountain ash trees may be seen in the Dandenong Ranges along Sassafras Creek and in the stand below the William Ricketts Sanctuary carpark. The Ada Big Tree Reserve and Cumberland Reserve contain some very large old trees, although both stands are in decline. The drive along the Black Spur features 10 km of tall 1939 regrowth trees towering over an understorey of tree ferns. Impressive stands of trees can also be observed along the road from Belgrave to Monbulk in the Dandenong Ranges, and along Meyers Creek Road from Healesville to Toolangi. The best place to see remnant mountain ash forest in the Strzelecki Ranges is at the Tarra Bulga National Park. Maits Rest, along the Great Ocean Road, contains the most easily accessed tall, old-growth trees of the Otway National Park.

Comparison with other States

The tallest known Victorian tree reaches 91.6 m, but this figure is surpassed by a number of mountain ash trees in the Andromeda Reserve in the Styx Valley, Tasmania, the tallest being 96.5 m and another 94.3 m. Both of these trees, however, have dead tops and are not likely to remain at this height for long[2].

The Western Australian tree, karri, *E. diversicolor*, also attains a great height. The tallest known specimen, the 'Stewart Karri', is listed at 85 m (CALM 1993; Carder 1995), but the two tallest karri measured by laser rangefinder on a recent fieldtrip were 80.1 and 80.5 m (S. Sillett, *pers. comm.* 2002).

New South Wales has a specimen of white gum (*E. nobilis*) that is reputed to be 79.9 m tall, whilst the tallest flooded gum (*E. grandis*)

[1] Unpublished data on height and diameter growth of regrowth *Eucalyptus regnans* stands. Department of Natural Resources and Environment, Victoria , Melbourne.

[2] These trees were measured by climber-deployed tape and laser rangefinder in October 2001 and March 2002.

reaches 76 m (Ponder 2000). There are no reports of trees ≥80 m from Queensland, South Australia or the Northern Territory.

Thus it would appear that mountain ash is the tallest tree in Australia by a wide margin, and that the 91.6 m tree growing in the Wallaby Creek catchment is the tallest tree on the Australian mainland.

Conclusion

Victoria's tallest known tree is a mountain ash 91.6 m tall growing in the Wallaby Creek catchment of Kinglake National Park. This is 10 m taller than the commonly recognised Cumberland tall tree, which currently stands at 81.5 m. More than 50 other trees were found to exceed the 81.5 m mark. The 91.6 m specimen is the tallest known tree on the Australian mainland, but it is surpassed by a Tasmanian tree of the same species.

Regrowth mountain ash trees resulting from fires in the 1920s and 1939 are still growing vigorously, and it is predicted that some of these will surpass the 90 m mark over the next 50 y.

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References

Ashton, D.H. (1976) The development of even aged stands of *Eucalyptus regnans* F.Muell. in central Victoria. *Australian Journal of Botany* **24,** 397–414.

Ashton, D.H. (2000) The environment and plant ecology of the Hume range, central Victoria. *Proceedings of the Royal Society of Victoria* **112,** 185–278.

Banks, J.C.G. (1994) Dendrochronological study of regrowth, mature and senescing *Eucalyptus sieberi* trees, Cobon Block. In: Widget, P.W., Peel, W.D., Written, K.T., Coram, J.E., Brady, A., Rule, A.J. and Banks, J.C.G. *A Study of Old Growth Forests of East Gippsland*. Department of Conservation and Natural Resources, Melbourne, Victoria, pp. 204–214.

Caire, N.J. (1905) Notes on the giant trees of Victoria. *The Victorian Naturalist* **21,** 122–128.

CALM (1993) Large Tree Register. Internal document of Department of Conservation and Land Management, Western Australia.

Carder, A.C. (1995) *Forest Giants of the World, Past and Present*. Fitzhenry and Whiteside, Ontario.

Cornthwaite, G. (1925) Tallest trees recalled. *The Gum Tree,* September 1925, p. 13.

Costermans, L. (1983) *Native Trees and Shrubs of South Eastern Victoria*. Revised edn. Weldon Publishing, Melbourne, 422 pp.

Forestry Tasmania (2000) Giant trees policy. <http://www.forestrytas.com.au/forestrytas/pages/tall_trees_register.html>

Grescoe, A. (1997) *Giants, the Colossal Trees of Pacific North America*. Raincoast Publishing, Vancouver.

Griffiths, T. (1992) *Secrets of the Forest: Discovering History in Melbourne's Ash Range*. Allen and Unwin, Sydney. 212 pp.

Hardy, A.D. (1935) Australia's giant trees. *Victorian Naturalist* **51,** 231–241.

Hickey, J.E., Sargison, G.J. and Kostaglou, P. (2000) Tasmania's tallest trees. *Tasforests* **12,** 105–121.

Jacobs, M.R. (1955) *Growth Habits of the Eucalypts.* Government Printer, Canberra, 262 pp.

Mace, B. (1996) Mueller, champion of Victoria's giant trees. *The Victorian Naturalist* **113,** 161–165.

Maiden, J.H. (1907) The giant trees of Australia. In: *Forest Flora of New South Wales.* Government Printer, Sydney, pp. 161–165.

McWhirter, N.D. (ed.) (1984) The plant kingdom. In: *Guinness Book of Records.* Guinness Superlatives Limited, Enfield, England. (The Australian edition of the 30th Edition (1984) contains an Australian supplement that adds to the information about tall trees in the main text.)

Munro, G. (1992) Cumberland Scenic Reserve. In: Griffiths, T. *Secrets of the Forest: Discovering History in Melbourne's Ash Range.* Allen and Unwin, Sydney, pp. 190–194.

Pierce, J.D. (1890) *The Giant Trees of Victoria.* (Folio of photographs.) Victorian Government, Melbourne.

Ponder, W. (2000) *Reaching for the Sky, the Tallest Tree in NSW*. State Forests of NSW, Sydney, NSW.

Simpfendorfer, K.J. (1982) *Big Trees in Victoria*. Forests Commission, Melbourne.

Yen, A.L. (2001) Insect outbreaks. In: Griffiths, T. *Forests of Ash.* Cambridge University Press, Port Melbourne, pp. 168–169.