Vulnerability of Tasmanian giant trees

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Summary

Tasmania's giant trees are among the world's tallest flowering plants and Australia's greatest eucalypts. However, they are not well protected in National Parks or extensive reserves.

Of the 69 known trees that meet the official criteria for protection as giants, almost 90% are in State forests managed for wood harvesting. Several of the giants are within coupes that were scheduled for clearfelling under the Tasmanian 2004–2007 three-year wood production plan, and recent harvesting operations have threatened or killed several others.

Fifty-five per cent (38) of the known Tasmanian giants, including the tallest trees, the tallest stand, the tallest stringybark, and the second most massive stringybark, exist in the middle of the Styx Valley. Harvesting and regeneration burning operations indirectly threaten most of these trees, because they stand close to scheduled or recently clearfelled coupes. More importantly, increasing the proportion of young, dense, highly flammable eucalypt regrowth forest, at the expense and fragmentation of less flammable old-growth forest, seriously exacerbates the risk of wildfire, and invites annihilation of all the Styx Valley giants.

Nominal protection of individual giant trees in small (100-m radius) management decision classification zones, or stands of trees in reserves of a few hundred hectares surrounded by production forest, does not provide effective protection in the long term. Numerous historic and recent examples in Tasmania and Victoria show the failures of these well-intentioned small-scale conservation efforts. Giant tree conservation requires very long-term preservation of large areas of forest in which the frequency of wildfire is very low; it is incompatible with current Tasmanian forest harvesting and regeneration practices.

The Styx Valley contains the greatest number of, and many of the finest, giants existing in Tasmania. It also has high potential to produce another generation of great trees to stimulate wonder and admiration for the next half millennium. The best plan to ensure their long-term survival is to desist from forest harvesting and regeneration by fire, and to transform the entire valley into Australia's first large reserve dedicated to giant tree conservation.

Keywords: veteran or remarkable trees; *Eucalyptus regnans*; *Eucalyptus obliqua*; Styx Valley; Tasmania

Introduction

Tasmanian giant trees are the world's tallest flowering plants (Hickey *et al.* 2000); they attract a high level of interstate and international interest, and local recognition of their significance is growing. The Government's recent establishment, under the Tasmanian Community Forest Agreement (TCFA), of two reserves specifically dedicated to protection of giant trees in the Styx Valley (Tasmanian Government 2005) reflects that rising interest. Even so, most of Tasmania's giant trees are in State Forest and uncomfortably near recent or proposed forest harvesting operations, from which they are not well protected.

Since my fortuitous involvement in the 2002 discovery of Tasmania's largest tree, 'El Grande', and the subsequent failure to save it (Beale 2003), I have carried out part-time research and exploration for other giant trees in southern Tasmania. Most of my exploratory surveys have been on scheduled harvesting coupes in the Styx and lower Florentine Valleys, with the objective of discovering the giants before logging commences so that they are not inadvertently felled and in the hope that harvesting plans can be altered to preserve the trees. This is a voluntary co-operative effort, contributing to Forestry Tasmania's policy of seeking 'to identify, manage and protect giant trees on State forest in Tasmania' (Forestry Tasmania 2002).

This paper presents a spatial analysis of giant tree distribution in Tasmania. It draws attention to the continuing threats to the existing giant trees, and proposes more effective broad-scale conservation measures to improve their chance of survival.

Appreciation of giant trees

In colonial times, giant trees in south-eastern Australia's forests were sources of great admiration and pride, and there was lively contention to claim them as the world's tallest trees. During the late 19th century, even as they strenuously cleared the forests for timber and farmland, Victorian colonists declared their mountain ash trees were rivals of the mammoth Californian sequoias.

The tallest, reliably measured, living Australian tree was at Thorpdale, Gippsland. It was measured at 114 m (374 ft) tall by qualified surveyor George Cornthwaite in 1881, and then it was cut down for verification. An 11.4 m high pole now inadequately

marks its place (Griffiths 2001). Some other Victorian tree height estimates proved to be remarkably less accurate. Motivated by fame or profit, and understandably eager to show up the Americans, our colonial giant enthusiasts sometimes over-estimated their tree heights and embellished their anecdotal reports. The discoverer of 'the Baron' (named after botanist Ferdinand von Mueller) initially measured it in the late 1870s at 160 m tall, and a decade later reported it as 142 m tall after its top had been blown off. When finally measured by theodolite, its height turned out to be 67 m — less than half of the original estimate (Bonyhady 2000). In 1888 the Victorian Centennial Exhibition committee, hoping to obtain impressive photos and specimens for the Exhibition, generously funded a systematic survey of giants and offered a prize of £20 for any tree over 400 ft (122 m) tall, plus £3 for each additional 5 ft. Their Chairman, James Munro, offered an extra incentive of £100 from his own pocket. It stimulated great interest and search effort, but nobody was able to claim these rewards.

The North Americans were ahead of us in giant tree conservation: in 1864, President Lincoln had protected some of the best sequoias, in the two-mile-square Mariposa Big Tree Grove. Amidst the general interest in world records, there were a few Australians, such as von Mueller and photographer Nicholas Caire, who were acutely aware of the giants' vulnerability to timber men, settlers and bushfires, and campaigned for their conservation on aesthetic grounds. Von Mueller called for these 'wonders of the empire of plants' to be 'retained as state property, duly protected by law' so that 'the next generation may yet enjoy a view of these living wondrous structures of centuries' (Bonyhady 2000). Regrettably, their calls for preservation were largely unheeded and ultimately ineffective. Most of the very tall Victorian trees were gone by the 1870s — ring-barked, burnt and cleared for farming, or felled by timber getters and shingle splitters who worked through the ranges, taking the longest-barrelled trees first.

The tallest tree found and measured by the 1888 Centennial survey was at Mt Baw Baw in Gippsland, and it 'was disappointing' at only 99.4 m (326 ft) tall (Maiden 1907). It was one foot higher than the tallest sequoia known at that time but, incredibly, paling-getters felled it a few years later, and split it into six thousand six-foot palings (Bonyhady 2000). Massive trees were esteemed as well as the tallest. The Neerim Monarch tree, 20 m in girth and about 61 m tall, brought fame and tourists to the Neerim district, Gippsland, in the 1880s (Fig. 1). George Perrin, the Victorian Conservator of Forests, promised to protect it after his visit in 1894, but it was ravaged by bushfire a fortnight later. It was still an attraction — because the tree was then more visible from the road — and Perrin proceeded to establish a 4-acre reserve around it. However, the fence had fallen in disrepair by 1901, and by 1904 the tree was 'reduced to ashes' (Bonyhady 2000). 'Big Ben' on the Black Spur, with a girth of 17.5 m, was another splendid mountain ash, killed by bushfire in 1902 (Bonyhady 2000).

The point to be emphasised here is that the Victorian colonial interest and efforts at conserving individual trees largely failed to effectively protect those isolated exceptional giants.

A stringybark at Geeveston, 61 m tall and 12 m in girth, was possibly the first Tasmanian tree recognised for its heritage value. In 1880, acting Governor Lefroy arranged to have it preserved by placing a plaque, which declared: 'This Giant of Tasmanian woods is at the special request of Lady Lefroy to be preserved as long as Nature shall spare it, to show posterity what the forests of Tasmania were in the days when 'A man was famous according as he lifted up axes upon the thick trees'. Psalm LXXIV,V' (Bonyhady 2000).

The effectiveness of its preservation by plaque is unknown.

That high regard for giant trees persists today. A little browsing of the Internet now reveals a multitude of organisations interested in giant trees, 'champion' trees and heritage trees, especially in North America and Great Britain. Recent events in Tasmania have rekindled local awareness of giant trees, and concern for their conservation. The news of El Grande's demise in 2003 went around the globe. It was the world's most massive eucalypt; discovered in a central Tasmanian logging coupe during clearfelling and nominally protected, but subsequently killed by an out-of-control regeneration fire (Beale 2003).

During the past decade, the Styx Valley has emerged as the focus of Australian forest cultural-conservation activities such as the tallest Christmas Tree, the 2003–04 Global Rescue Station, the 2003 Styx Forest Rally and associated artistic events, which have

Figure 1. The Neerim Monarch, Gippsland. Photo by J. Duncan Pierce, 1888; reproduced from Bonyhady (2000)

done much to re-engender many people's appreciation of giant trees. This is daily evident during the tourist season by the number of interstate visitors to the Styx 'Big and Bigger' Tree Reserve and other points of interest in the valley. The Styx Valley also has historic significance in its nominal giant tree protection dating back to the mid-1950s. Kostoglou (2000) referred to Australian Newsprint Mills' (ANM) 1956 discovery of a tree 98 m tall at the Andromeda stand, which has been informally reserved since the 1960s (Sargison 2005). This appears to have been one of the earliest post-war Tasmanian efforts at protection of giant trees, and we are fortunate that ANM's pioneering foresters had the forethought to spare them. The recent Tasmanian Community Forest Agreement (TCFA) includes these Andromeda trees in a 336-ha 'Tall Trees Reserve', which 'will enable visitors to access, enjoy and marvel at the tallest flowering plants in the world' (Tasmanian Government 2005). This is a step in the required direction but, as elaborated below, the area is insufficient to ensure their long-term protection amidst ongoing harvesting.

Until a few years ago, there was little official documentation or recognition of Tasmanian giant trees, apart from dedication of a few small forest reserves, e.g. Evercreech in the upper South Esk Valley, with its 89-m tall white gum (*E. viminalis*) (Hickey *et al.* 2000). When Victorian-based artist Brett Mifsud commenced Tasmanian giant tree searches in the 1990s, he found that information was sparse and mainly anecdotal. Forest conservation campaigns spearheaded by The Wilderness Society sparked the public interest in tall trees at Beech Creek near Wayatinah in the 1980s, and subsequently a decade later in the Styx Valley. Responding to the growing public attention, Forestry Tasmania (FT) commissioned a survey in early 2000 to measure the heights of Tasmania's tallest trees (Kostoglou 2000). At that time, height was the main criterion for recognition of exceptional trees. Kostoglou (2000) compiled historic reports of Tasmanian trees up to 101 m tall and noted that these were considerably shorter than estimates of Victorian tree heights in the 19th century. The loftiest tree measured in the 2000 survey was 92 m tall — 1 m taller than the tallest existing, reliably reported Victorian tree — and therefore just sufficient for Tasmania to claim the world's tallest hardwood (Hickey *et al*. 2000). The ten tallest Tasmanian trees then exceeded 85 m, and this apparently inspired Forestry Tasmania to set the threshold for giant tree protection in state forest at that height. The policy was revised to include trees of large volume in 2002, following the discovery of El Grande, which has an impressive girth of 19 m, but at 79 m tall it would not have otherwise qualified for giant protection. Largely due to the work of a few amateurs, the number of recognised giants has considerably increased in the past 5 y, and the tallest now is 97 m.

Tasmanian definition of giant trees

Forestry Tasmania's giant tree policy (Forestry Tasmania 2002) defines giants as 'trees that are at least 85 m tall, or at least 280 m^3 estimated stem volume'. Its 'Standard Operating Procedure for Giant Trees' states that 'All trees greater than 4.5 m dbhob or greater than 80 m in height will warrant measurement to confirm whether they meet the above definition' (of giant trees) (Forestry Tasmania 2004b).

For reconnaissance purposes, an empirically-derived formula is used to estimate stem volumes from tree heights and circumferences. This is unlikely to be accurate for trees of diverse age, species and form, and it is known to significantly underestimate the actual volumes of some massive giants (e.g. El Grande, Arve Big and Still Sorrow).

Under the Standard Operating Procedure for Giant Trees, 'all potential giants are given an interim protection zone of 100 m radius prior to formal measurement' (G. Sargison, Forestry Tasmania, *pers. comm.* 2004). Following verification, Forestry Tasmania receives advice from its Giant Trees Technical Committee (GTTC) on the area and management of appropriate protection zones.

Distribution of Tasmanian giants

The register of the Tasmanian Giant Trees Consultative Committee (GTCC) currently lists 69 giant trees, including 50 ≥ 85 m tall and 24 ≥ 280 m^3 estimated volume (Giant Trees Consultative Committee 2005). Five trees qualify as giants under both height and volume criteria (Appendix 1). All of the known giant trees are eucalypts; most (85%) are *Eucalyptus regnans*.

Figure 2 shows the locations of areas in Tasmania where giant trees have been found. Apart from isolated giants at Blue Tier, Evercreech, Reynolds Falls, Little Denison River and Arve River, most of the big trees are in the Styx, Florentine and Derwent valleys. Of the 69 giants, only eight (12%) are in the Wild Rivers National Park: two at Upper Coles Creek, and six at Beech Creek-Wayatinah. The tallest of those is 86 m tall and the most massive has an estimated volume of 307 m^3; i.e. the recognised giants in National Parks are in the lower third of the 50 known tall giants,

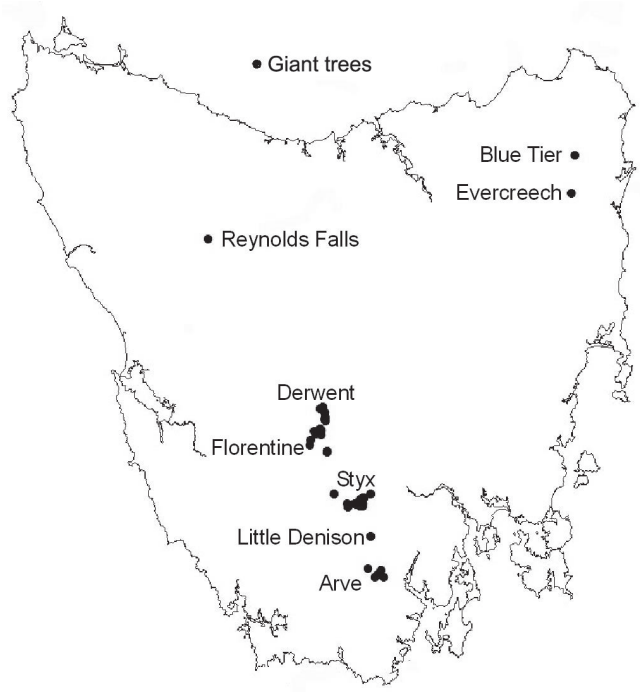

Figure 2. Distribution of giant trees in Tasmania

and lower half of 24 massive giants. The nameless *E. obliqua* near Reynolds Falls is in a Nature Conservation area.

All of the other 60 giants (87%) are in State forests. One of them is dead (El Grande), and five of them (7%) are in Styx Valley logging coupes that were scheduled for harvesting in the 2004–2007 three-year wood production plan[1] (Forestry Tasmania 2004a). At least that many other giants stand at the edges of recently-clearfelled coupes, having been discovered during or after logging (e.g. Damocles, Plumpton, Blue Spur and two blue gums (*E. globulus*) at McDougalls Road).

Thirty-eight of the known giant trees (55%) are in the Styx Valley. They exist in an area 7 km × 12 km, in the middle of the valley, between South Styx River and Diogenes Creek, essentially between the Maydena and Snowy Ranges at altitudes of 300–550 m (Fig. 3).

Virtually at the centre of this district, in a strip 900 m × 400 m on Andromeda Spur, there is a cluster of eighteen giant *E. regnans* trees (26% of the total number). This small area is the 'epicentre' of Tasmanian tall trees. It includes the three tallest trees (Icarus' Dream, Mount and TT31) and 12 (75%) of the 16 known Tasmanian trees over 90 m tall. At Skeleton Road, 2 km south of Andromeda, stands the second most massive known living eucalypt (Chapel Tree, 85 m tall, ~350 m^3); it is one of only five trees to qualify for giant status by both height and volume. The tallest known stringybark (Boreas, 88 m, *E. obliqua*) stands near the north bank of the Styx River less than 1 km to the north-west of the Andromeda stand. The second most massive stringybark (Gothmog, ~329 m^3, *E. obliqua*) grows less than 1 km to the south-east.

In summary: nearly 90% of known Tasmanian giant trees are in State forests. The Styx Valley contains nearly two-thirds of the giants, three-quarters of the tallest trees, and several other highly significant giants.

Styx Valley giants in relation to forestry operations

The map in Figure 4 shows the locations of the known giant trees in the Styx Valley, in the context of the areas clearfelled during the past 45 y, and the remaining areas of tall forest (photo-interpreted forest types E1and ME1), which have the greatest

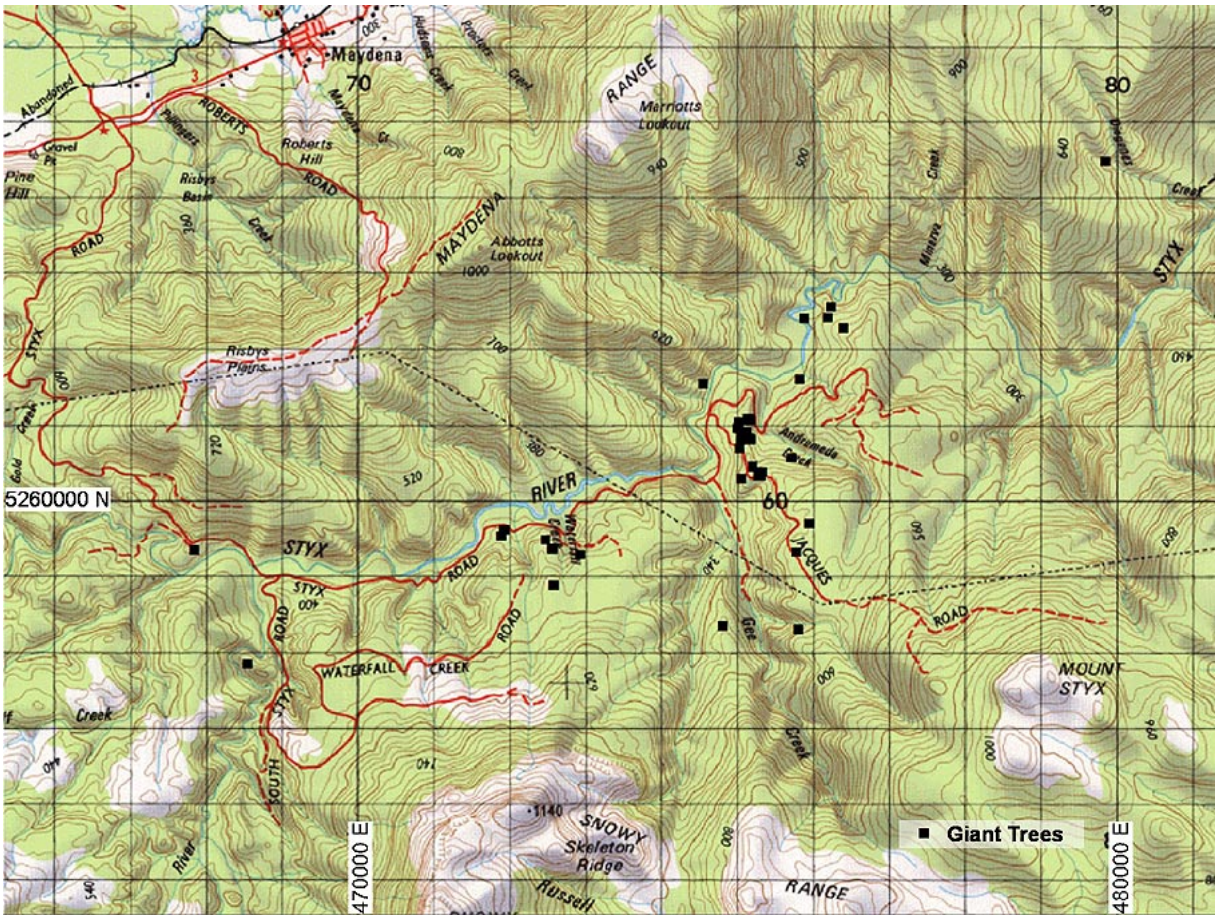

Figure 3. Distribution of known giant trees in the Styx Valley

[1]Three Styx Valley coupes (SX13C, SX18E and SX19A; delineated in Fig. 5), which contain giants, will probably be either removed from harvesting plans, or have their boundaries altered, because of the new reserves established under the TCFA in May 2005.

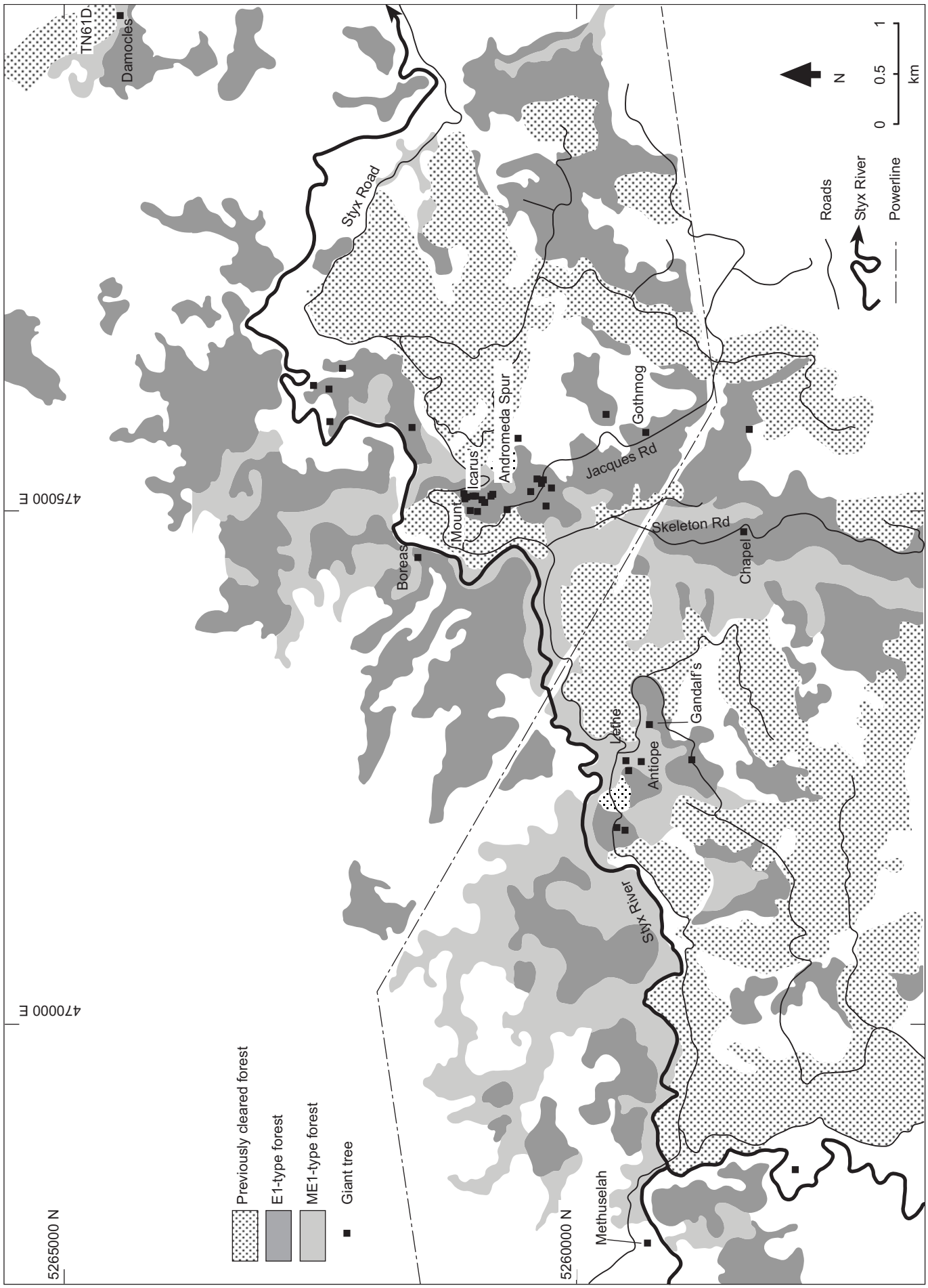

Figure 4. Styx Valley giant trees in relation to extent of previous clearing and remaining tall forest

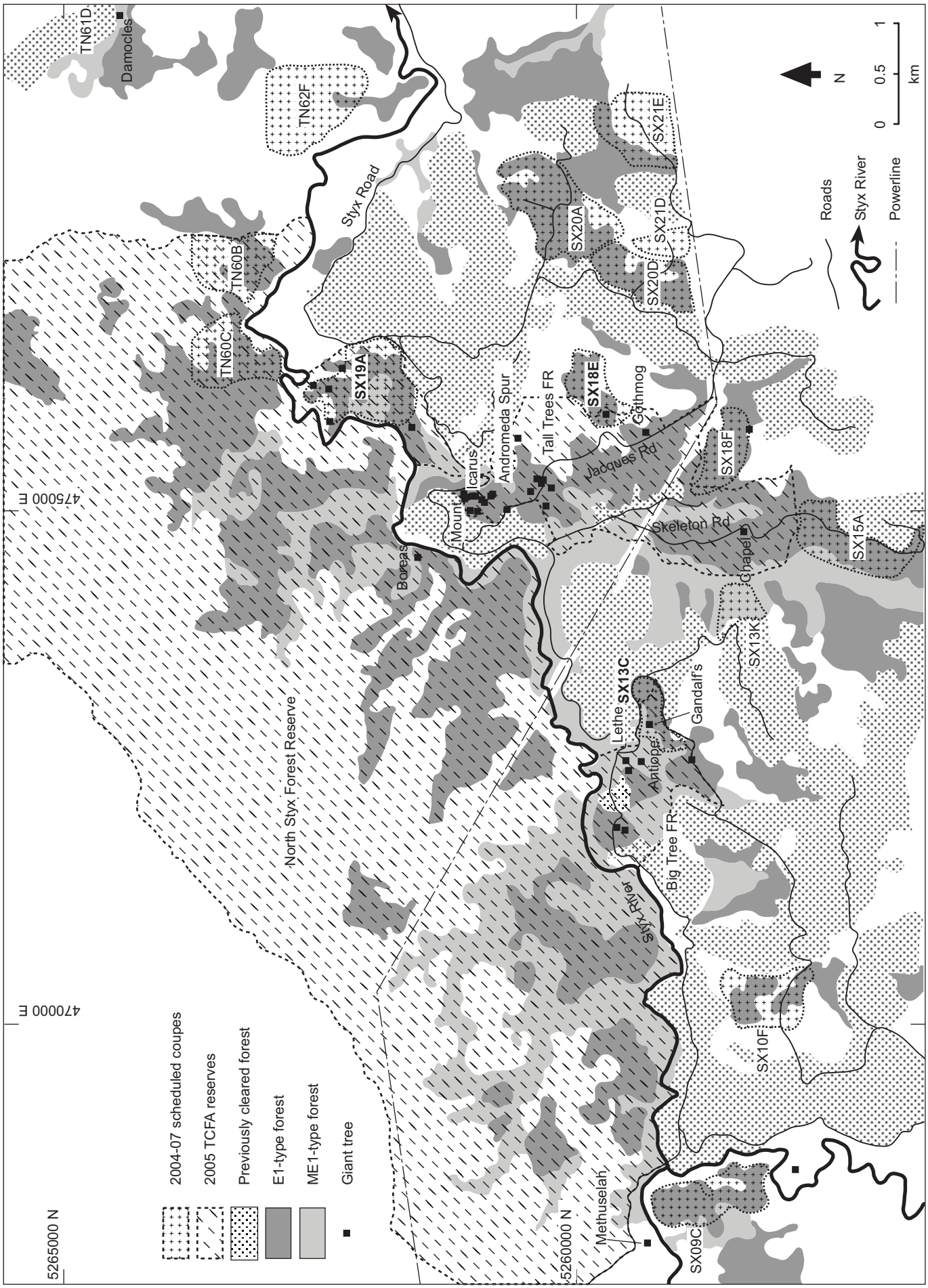

Figure 5. Areas of proposed TCFA (2005) reserves in the Styx Valley, and coupes scheduled for clearfelling in 2004–2007

potential to contain undiscovered giants[2]. Figure 5 shows the same details overlaid by the areas of the 2005 TCFA-proposed reserves (Tasmanian Government 2005) and the coupes scheduled for harvesting in 2004–2007 (Forestry Tasmania 2004a)[3].

Several features of these maps are worth emphasising:

- Logging during the past 45 y has significantly diminished and fragmented the area of tall forest, to the extent that the previously-cleared area now exceeds that of E1 forest remaining south of the Styx River.
- Of the 15 coupes within the 12 km × 9 km area of Figure 5 that were scheduled for harvesting in the 2004–2007 three-year wood production plan, all but three (SX13K, SX21D and TN62F) are in E1-type tall forests with high giant-bearing potential. In other words, about 80% of planned logging is focused on tall old-growth forest.
- Four of the 2004–2007 scheduled coupes (SX 13C, 18E, 18F and 19A) include known giant trees.
- Two of the 2004–2007 scheduled coupes, SX 18E and 19A, are within 1 km of the highly significant tall giants on Andromeda Spur.
- Only one of the 38 known Styx giants stands more than 1 km from the boundary of the nearest scheduled coupe (Boreas; 1.3 km west of SX19A).
- The newly proposed (2005 TCFA) reserves enclose most of the known giants in the Styx Valley, but many of the trees are very close to the reserve boundaries and hence vulnerable to edge effects and fire.

Vulnerability of Styx giants

Harvesting and regeneration burning operations obviously seriously threaten the several giants that stand within 2004–2007 planned coupes. Trees in these situations are nominally protected in Management Decision Classification (MDC) Zones. The actual areas of these zones for specific trees, or details of future conservation management, are not publicised but it seems that zones of 100 m radius are typical. Leaving a giant tree standing in the midst of a clear-felled and burning coupe does not equate to effective protection. Forestry Tasmania has publicly acknowledged that vulnerability (Sayer 2003). The demise of El Grande, apparently despite best intentions, was a convincing case in point (Beale 2003).

Giants that stand within a few hundred metres of planned coupes are similarly menaced by post-clearing regeneration fires, which frequently exceed the boundaries of their coupes. Law (2001a) referred to an escaped regeneration burn in the Styx Valley which 'wiped out' old-growth forest and about 500 ha of plantations. Among others in the Styx, the regeneration fire at coupe TN61D (at the north-east corner of Fig. 4) is a recent example. The southern boundary of this coupe is about 50 m north of Damocles, which is the fourth-tallest known giant tree, the only tree > 90 m tall known in the Styx Valley outside the Andromeda area, and therefore the only tree > 90 m in the Valley not previously damaged by fire. This significant giant was discovered while the coupe was being clearfelled in 2003, and my written expressions of concern for its safety if the coupe was burned were disregarded by Forestry Tasmania (G. Sargison, Forestry Tasmania, *pers. comm.* 2004). The subsequent regeneration fire on TN61D in March 2004 crossed the strip of rainforest along Diogenes Creek, and burnt out patches of regrowth forest several hundred metres east of the coupe. People from the Global Rescue Station, who witnessed the fire, reported that it was unattended by forestry personnel on the evening when it was 'fairly raging' out of control (Anne and Jannes, Global Rescue Station volunteers, *pers. comm.* 2004; Anne and Jannes 2004). Damocles is fortunate that it was a west wind, and not a northerly, that drove the fire beyond the coupe boundary. Figure 6 illustrates its precarious proximity to the burnt area. Prior to the adjacent clearing and burning,

Figure 6. Damocles (mid-frame) in the Styx Valley, 50 m outside logging coupe TN61D. This photograph was taken a few days after the coupe was burnt in March 2004.

[2] The areas of extant tall forest were traced from Forestry Tasmania's 1:25 000 scale photo-interpreted forest type maps. E1 types are mature eucalypt forests with average heights of 55–76 m, and ME1f refers to rainforest with < 5% crown cover of E1 tall eucalypts (the f designating the density of the eucalypts). Although the frequency of eucalypts in type ME1f is low, they are very mature forests and hence potentially contain very old, perhaps massive, giants (e.g. Lethe and Antiope, just west of SX13C and Waterfall Creek).

[3] The scheduled coupe boundaries shown in Figure 4 are approximate; Forestry Tasmania does not publicly divulge planned coupe boundaries. These boundaries were deduced by the author from the forest type, topography and drainage, and co-ordinates of the coupe centroids and coupe areas, as published in Forestry Tasmania's 2004–2007 three-year wood production plan, which is the latest publicly available harvesting schedule (Forestry Tasmania 2004a).

Damocles had a near-perfect form and healthy crown (Fig. 7), which contrasted with fire-damaged trees elsewhere.

Likewise, tall trees left standing at the edges, or in small clumps in the midst, of cleared coupes are at greater risk from storm wind damage. Mifsud (2003) cited an example in Victoria's Cumberland scenic reserve, where a stand of 27 tall trees, of which the tallest was reputedly 92 m, was protected in the 1920s to 'preserve a sample acre' amongst the stumps of a sawmilling district. Unfortunately, a 1959 windstorm blew down 13 of the trees and reduced the tallest to 84 m.

These boundary-related threats to individual or groups of giant trees are the immediate, localised, consequences of forest harvesting and subsequent regeneration fires. However, they are overshadowed by the gradual, long-term and more-pervasive risks caused by increasing the area of regrowth and plantation forests through continued clearfelling. The mature giant eucalypts in the Styx typically co-exist with rainforest understoreys of myrtle-beech, sassafras and celery-top pine. They are commonly callidendrous, with relatively open floors of ferns and mosses, locally closed with tree ferns, or thick horizontal or laurel scrubs. Such forests are perpetually damp and relatively non-flammable (Jackson 1978). The reduced wildfire frequency after these forests reach a certain age, perhaps beyond a century or so, is an important conducive factor in allowing the eucalypts to grow to full giant maturity. In contrast, the dense stands of young eucalypt regrowth and plantation forests, which supplant the old forests after clearfelling, are highly flammable. Frequent fires, as Jackson (1978) pointed out, promote 'ecological drift' towards dominance of sedgeland and scrub, at the expense of mature eucalypt forest and rainforest.

An old giant standing in a large tract of mature mixed eucalypt-rainforest is substantially protected from wildfires by the damp forest around it, whereas a tree surrounded by, or adjacent to, a large area of young eucalypt regrowth has a greatly diminished chance of surviving a fire.

Clearly, incremental increases in old-growth forest harvesting and regeneration in the Styx Valley increase the wildfire threat to its giant trees. In view of the significant inroads to date, and if the acceleration of harvesting continues at the rate scheduled for the next 3 y, it is difficult to envisage any substantial tracts of E1-type tall old-growth forest remaining in the middle Styx Valley in a decade. The largest remaining patch of E1 and ME1 forest south of the river is centred on Skeleton Road. It is now a little over 3 km long and 1–2 km wide. Clearing of the south-eastern part of coupe SX15A in 2003 seriously compromised its integrity, and further harvesting of 2004–2007 scheduled coupes SX13K, 15A and 18F would reduce it to a few semi-connected scraps, none greater than 1 km square. The Styx giants are not immune to bushfires, and every additional clearfelled coupe and regeneration fire exacerbates the risk of wildfire.

Effects of fire on giant trees

Supporters of current Tasmanian forest practices frequently claim that clearfelling and regeneration firing emulate natural cycles, and that eucalypts are fire-hardy (e.g. Tasmanian Forest Industry

Figure 7. Damocles: its relatively healthy crown and lack of epicormic branches compare favourably with those of fire-damaged trees of similar age but at the Andromeda stand (Figs 8–11)

2005). Eucalypts and many other native plants have reproductive systems that are certainly well adapted to re-colonisation after fire, some of them can survive fire, but none thrives on fire. To quote Professor Jamie Kirkpatrick: 'I think it can be fairly said that there are very few examples in Tasmania of native vegetation that has been improved by firing, and that there are a lot of native ecosystems that have been degraded by firing' (Kirkpatrick 1978, p. 94). Old giant *E. regnans* trees are least of all improved by fires — as demonstrated by El Grande. After accidentally burning the supreme giant, Forestry Tasmania claimed that El Grande had showed its natural resilience to fire, that it had endured many wildfires in its ~350-y history, and that it would re-sprout after a while (Whiteley 2003). This optimism was contradicted by contemporary botanic opinion (Paine 2003), and the tree eventually refuted it unequivocally (Sayer 2003).

Williams and Potts (1996) stated that '*Eucalyptus regnans* lacks lignotubers and is usually killed by fires of sufficient intensity to burn rainforest or wet forest…'. However, some eucalypts do survive bushfires, and even the thin-barked *E. regnans* may survive a low-intensity fire. The tall giants on Andromeda Spur are outstanding examples that bear grim reminders of damage by

fire. A fire that apparently followed clearfelling of the western fall of the spur, circa 1962, burned across the top of the spur, through the tall trees that had been reserved there, and down the eastern slope. This fire history is evident in its present-day scrubby wet sclerophyll-type understorey, the presence of *E. regnans* saplings, and particularly in the forms of the giants. The Mount Tree, which until recently was regarded as the tallest, has several large fire scars around its butt (Fig. 8), and its crown consists of a few scrappy epicormic branches amongst the original, now dead, heavy spars (Fig. 9). Comparative photos from 1962 and 2001 (Fig. 10) illustrate a remarkable decline in the health of this tree. In 1962, all the branches in the crown bore leaves at their extremities, even at the very top, and it had the appearance of a tree still growing. It appears to have then been a metre or two taller than its current 96 m. It is reasonable to speculate that if it had not been sickened by fire, perhaps also by exposure by clearing to its immediate west, it may have now exceeded 100 m height. The 1962 photo shows relatively open undergrowth exposing most of Mount's trunk, and a partly burnt, broken tall stem nearby to its left. These suggest that this early photo was taken after the fire, and that the fire did not burn Mount's leafy crown. Nevertheless, Mount is now a skeletal shadow of its former majesty, and there is not much doubt about the cause.

Icarus' Dream, recently declared the world's tallest hardwood (Beale 2005; Sargison 2005), stands on the steep eastern fall of the Andromeda spur, about 150 m east of Mount. It has traces of charring on its butt, the upper two-thirds of its long stem is covered with bushy epicormic growth, and the branches in its insignificant crown are dead (Fig. 11). Forestry Tasmania's media release (Sargison 2005) suggests the dead top 'reflects its advanced age'. I suspect that it was half-killed by fire, and that if a 1960s, pre-fire, photograph were available it would depict, like Mount, a tree then in its middle-aged prime.

Most of the other giants in the Andromeda stand are also now epicormic-covered, dead-crowned ruins: still tall but rather sad. They 'have been reserved in the Andromeda area of the Styx Valley since the 1960s' (Sargison 2005) but their lives and statures were seriously shortened by adjacent logging and fire-assisted regeneration. These eminent Andromeda trees exemplify the incompatibility of giant protection with forest harvesting and fire. Their habitat was drastically altered, they struggle to survive but grow no taller, and their scrubby sclerophyll understorey is in no way comparable to the beauty of the callidendrous old forest. This is not a model of giant tree protection that we should aspire to.

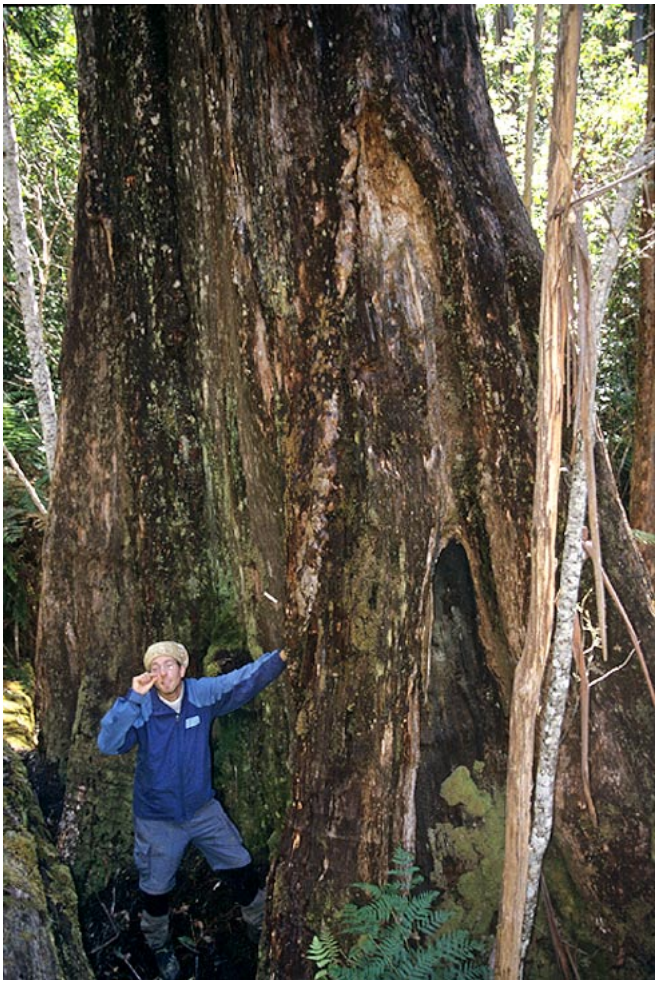

Figure 8. Old fire scars on the lower trunk of the Mount Tree, 96 m tall, at Andromeda Spur, January 2004

Figure 9. Dead spars and small epicormic branches at the top of the Mount Tree, January 2004; foliage at the lower right is on an adjacent tree

Figure 10. Photographs of the Mount tree in 1962 (left) and 2001 (right), showing crown dieback after fire (re-scaled from: www.gianttrees.com.au/pages/mount.htm)

A fire frequency of less than one fire every 500 y seems to favour giant eucalypt preservation and growth. Mifsud (2003) estimated that all of the Victorian giants >85 m 'are well over 150 y old', and Hickey *et al.* (2000) accepted that the Tasmanian giants generally exceed 300 y, with a maximum life span of about 450 y. Wherefrom, it is obvious that the 'natural' interval between fires before European settlement (~200 y ago) was sufficient to 'regenerate' the giant eucalypts that exist today, and yet low enough to allow them to grow to giant maturity. This refutes the argument that forests must be artificially managed (regularly burnt) to prevent them from being replaced by climax rainforest. The challenge in giant tree cultivation is to allow long-term growth, not to promote short rotations. The large proportion of modern bushfires that are anthropogenic suggests that best

Figure 11. Dead crown of 97-m tall Icarus' Dream, and epicormic branches on the upper two-thirds of its stem, probably related to fire damage circa 1962. Photographed in March 2005.

management of a giant tree forest would require extinguishing most fires, if possible. If, under unusual circumstances, no fires eventuated in more than five centuries or so, then deliberate controlled burns could be considered in order to maintain eucalypt forests.

Better protection for the Styx giants

The Styx Valley is obviously favourable habitat for giant trees, and there are sound reasons why it should become Tasmania's first bio-region dedicated to giant tree conservation. It has the greatest number and concentration of giant trees, it has the tallest trees, and it has some of the largest stringybarks and a number of other significant or distinctive trees. Existing giant trees are sometimes discounted (because, in timbermen's terms, they may be over-mature, senescent, or declining in old age) in favour of younger stands of vigorous trees, which are deemed to have potential as the next generation of giants (e.g. Graham Sargison, quoted in Wade 2002). Aside from being a dismissal of what already exists, it is a risky approach. Given the indications of industrially-related global climate changes, we cannot be confident that trees germinated today will experience the climatic conditions that evidently established the 200–400-y-old existing

giants. Although there are various opinions about the balance of factors that support giant tree growth — from freak genes to physiographic influences including elevation, slope, aspect, geology, fire history and climate — climate is obviously of critical importance. Despite those uncertainties, the known distribution of Tasmanian giants places the Styx Valley foremost as a location for tall trees of the future.

The foregoing empirical analysis points to the incongruity of forest clearfelling, regeneration burning and bushfires with the preservation of existing giant trees. Nowhere in Tasmania can we see giant trees that have benefited from forest harvesting. Probably many giants were felled without being recognised, particularly in the decades preceding the protection policy, and their territory in the Styx has been greatly reduced and fragmented during the last 40–50 y. The giants that remain have been fortunate; they exist more by good luck than good conservation. Many of them have been injured, despite foresters' well-intentioned restraints in not cutting them down.

The status of Victorian giant trees reflects the importance of district-scale land management above individual-tree protection. All of Victoria's tallest trees known today, including 24 that would qualify under Tasmanian giant criteria and many others that would not, stand in 'designated water catchments enclosed within the Kinglake and Yarra Ranges National Parks, which are completely protected from logging' (Mifsud 2003). In contrast, only seven known less-tall trees (74–81 m tall) exist in Victorian state forests. A recent survey of state forests in the 'Tambo and East Gippsland areas measured 15 583 individual trees …. only one of these trees was greater than 3.5 m diameter [11 m girth] …. confirming the rarity of these very large trees' (Redwood 2004).

Plainly, the most effective giant protection strategy is to completely cease further forest clearing and burning, and to somehow minimise wildfires, particularly human-originated fires. For reasons outlined above, and based on past Victorian and Tasmanian experiences, this type of management cannot succeed in small reserves of a few hectares, or even a few hundred hectares. It necessarily involves setting aside thousands of hectares to provide effective buffer zones against fires and windstorms, and to allow near-as-natural cycles of forest succession and regeneration. It reflects the well-established principle that effective bio-conservation requires extensive habitat preservation — it cannot be achieved by limiting protection to individuals or small groups.

In the Styx Valley, with its mosaic of previously logged areas amongst remaining old forest, effective giant conservation must involve taking a sizable area of existing state forest out of the harvesting plans. The three new TCFA reserves in the Styx Valley go part of the way, in that they encompass a nearly contiguous area of about 4700 ha. The area north of the Styx River includes significant proportions of alpine scrub and small eucalypt forests on the Maydena Range, and less than a quarter of it is tall forest (Fig. 5), but it has the advantage of being almost untouched — very little of it has been previously logged. Unfortunately, most of the giant trees are south of the Styx River, to be included in forest reserve 'promontories' that project southward from the larger North Styx Forest Reserve into timber harvesting zones, where they are still vulnerable by proximity. Most of the giants stand within 300 m of the proposed reserve boundaries[4]. The embayed nature of the proposed reserve boundaries makes the giants in them particularly susceptible to potential escapee regeneration fires on adjacent timber harvesting coupes.

A large tract of World-Heritage-listed land, the South-West National Park, already buffers the Styx Valley to the west and south. The addition of an area something like the ~17 500 ha previously proposed by The Wilderness Society as a Styx Valley of the Giants National Park (Law 2001b) would encompass all of the known giant trees in the Styx Valley, as well as most of the remaining tall old-growth forest, and would provide much greater protection against wildfires (Fig. 12). Obviously, it would be preferable to have a giant tree conservation bio-region protected deep within the world heritage area rather than near its eastern edge, but the history of settlement and forestry precludes that.

The area proposed in 2001 for the Styx Valley of the Giants National Park (Fig. 12) includes about 2500 ha which have been logged and are now covered by dense eucalypt regrowth less than 50 y old, and eucalypt plantations. These zones will constitute the major wildfire hazards during the next century, but if left to grow to full maturity may well produce a new generation of Styx giants. Brett Mifsud, an expert on Victorian giant trees including some which exist in regrowth stands < 80 y old, considers the 40–50-y-old regrowth forest along the Styx Road east of South Styx River has future giant tree potential (B. Mifsud, Sherbrooke, Victoria, *pers. comm.* 2005). Although these younger stands may be perceived as having low conservation value at present[5], they should be regarded as a future asset that could produce great trees to stimulate wonder and admiration for the next half millennium.

Unfortunately, we cannot preserve the tall forests and log them too — the conservation of the entire Styx Valley would come at some cost to the current timber industry. A consultancy commissioned by Forestry Tasmania (Felmingham 2001) concluded that the economic losses to the timber industry, offset by gains in tourism, would result in a State-wide negative impact of $17.5 million per annum. The publicly available executive summary of that report provides little detail on its research methodology, but it appears to have applied a short-term estimate of visitor numbers to a Styx giant tree reserve and overlooked potential for longer-term (10 y) growth in tourism, which would halve that negative impact (Graham 2001). Furthermore, wise management and upgrading of appropriate tourism infrastructure

[4] The TCFA reserve boundaries shown in Figure 5 are scaled up from a 10-cm-wide diagram published in a Government pamphlet (*A Way Forward for Tasmania's Forests*, Tasmanian Government, May 2005). Forestry Tasmania subsequently advised that those boundaries are 'provisional', to be finalised in 2006, and that maps that are more detailed will not be released until then.

[5] The Wilderness Society proposed to exclude these as enclaves from the park because past clear felling and roading had reduced their wilderness values; Law, G. (2001b) *A Proposal for a Styx Valley of the Giants National Park*, www.wilderness.org.au/campaigns/forests/tasmania/styx/styxnatp/.

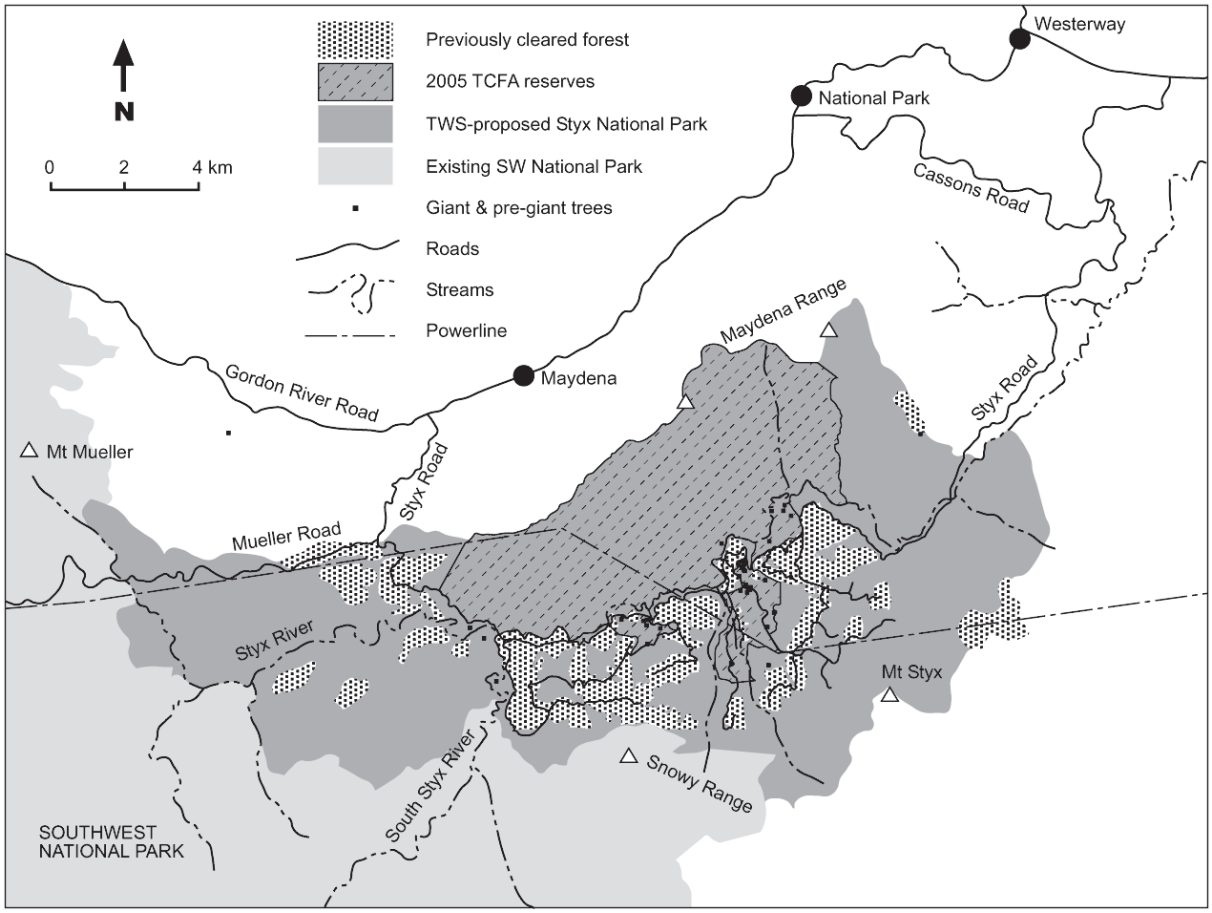

Figure 12. The area of about 17 500 ha proposed by The Wilderness Society in 2001 as an extension to the existing South-West National Park, to protect giant trees and other biodiversity and wilderness heritage values in the Styx Valley (modified from www.wilderness.org.au/campaigns/forests/tasmania/styx/styxnatp/)

has potential to create a sustainable industry, which harvesting of old-growth native forest clearly is not. In other words: today's old-growth forest logging industry is based on a rapidly declining resource, whereas nature-based tourism has great, yet un-realised, potential. A more detailed study of 11 geographically diverse native forest areas in eastern New South Wales found that 'recreation confers higher economic benefits than timber production, inclusive of estimated error statistics' for six of the sites, whilst variances in estimated economic values prevented conclusive assessment of the other five sites (Ward 2001). Modelling of those research data indicated that promotion of native forest recreation would maximise the economic values of individual state forests, as well as the combined economic benefits to society.

For a large majority of Australians, however, giant tree conservation is not merely about economic value — it is about heritage value. Consider the >133-m-long tree that William Ferguson measured in 1872 after it had fallen in a bushfire, the 114 m tall Thorpdale Tree felled in 1881 for verification of its height, and the 99-m tall tree discovered at Mount Baw Baw by the 1888 Centennial surveys and subsequently felled and split into palings. We are not much interested in the money realised by timbermen, or value lost in bushfires, when we reflect on these legendary giants of the past — we lament their loss, and imagine how splendid it would be if we could see them standing now.

Conclusion

The Styx Valley has the best of the old giant trees remaining in Tasmania, and a demonstrated potential to grow new ones into perpetuity. The current system of clearfall forest harvesting and regeneration by fire seriously threatens those existing and future giant trees in close proximity. If it were replaced by a valley-scale conservation area, the Styx giants might have the security, space and future they deserve.

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Appendix 1. Tasmanian giant trees

Tree identity	Species*	Height (m)	Girth (m)	Volume (m^3)	Name	Finder	Locality	Area	Tenure*
TT326	reg	97	9.1	164	Icarus Dream	Davey, Mifsud (2005)	Andromeda	Styx	SF
TT 94	reg	96	11.9	234	Mount Tree	Mount, Mifsud (2001)	Andromeda	Styx	SF
TT 31	reg	94	11.0	205		Mifsud	Andromeda	Styx	SF
TT 99	reg	92.9	10.6	163	Damocles	Herrmann	Diogenes Ck	Styx	SF
TT363	glo	92.3	12.2	233	Metakareta	Herrmann	McDougall's Rd	L.Denison	SF
TT 34	reg	92	8.4	140		Mifsud	Andromeda	Styx	SF
TT 36	reg	92	7.8	125		Mifsud	Andromeda	Styx	SF
TT182	reg	91.6	12.3	236	Plumpton Tree	Plumpton	Counsel	Derwent	SF
TT 32	reg	91.5	10.8	196		Mifsud	Andromeda	Styx	SF
TT 24	reg	91.5	10.3	183		Mifsud	Andromeda	Styx	SF
TT 30	reg	91	11.4	208	Andromeda Twin, W	Mifsud	Andromeda	Styx	SF
TT 96	reg	91	10.4	184	Andromeda Twin, E	Mifsud	Andromeda	Styx	SF
TT327	reg	91	9.5	163	Medusa	Mifsud, Greenwood	Andromeda	Styx	SF
TT 49	reg	91	8.6	142		Sillett	Andromeda	Styx	SF
TT 86	reg	91	7.4	115	Tom and Brett Tree	Mifsud	Manning Rd	Florentine	SF
TT 42	reg	90.4	9.1	153		Mifsud	Andromeda	Styx	SF
TT361	reg	89.7	15.6	296	Tomumcho	Burgess, Bradley, Ryan	Picton	Huon	SF
TT192	reg	89.1	15.4	320	Old Regret	Herrmann	Glow Worm Ck	Florentine	SF

Appendix 1. Tasmanian giant trees (continued)

Tree identity	Species*	Height (m)	Girth (m)	Volume (m^3)	Name	Finder	Locality	Area	Tenure*
TT 93	vim	89	10.4	180	White Knight	Historical	Evercreech	NE Tas	FR
TT274	reg	89	9.7	164	Ismene	Herrmann	SX19A (West)	Styx	SF
TT 72	reg	88.5	7.7	118	25th Floor	Mifsud	3 Huts	Florentine	SF
TT364	obl	88	11.0	193	Boreas	Herrmann	Nth Bank Styx R	Styx	SF
TT 79	del	87.9	9.6	161		Historical	Coles Rd	Florentine	SF
TT 48	reg	87	17.1	404	Arve Big Tree	Kostaglou	Arve	Arve	SF
TT 87	reg	87	14.8	234	Styx Bigger Tree	Mifsud	Styx	Styx	SF
TT 25	reg	87	10.9	118		Misud	Andromeda	Styx	SF
TT 26	reg	87	7.4	110		Mifsud		Styx	SF
TT 74	reg	87	5.1	64		Mifsud	Three Huts	Florentine	SF
TT273	reg	86.8	9.4	156	Elpenor	Herrmann	SX19A wp23	Styx	SF
TT276	reg	86.7	13.9	261	The Lawson Tree	Lawson	SX019A	Styx	SF
TT199	obl	86	12.8	230		Cohen, Robertson, Clark	Beech Ck	Derwent	NP
TT365	reg	86	12.7	228	Acrisius	Herrmann	Andromeda Ck	Styx	SF
TT 89	reg	86	12.1	220	Styx Big Tree	Mifsud	Styx	Styx	SF
TT 73	reg	86				Kostaglou	Three Huts	Florentine	SF
TT 68	reg	86				Kostaglou	Coles Ck	Florentine	NP
TT 64	reg	85.6	10.6	178		Plumpton		Styx	SF
TT325	reg	85.4	12.8	208	Pagewell Tree	Page, Blackwell		Styx	SF
TT314	reg	85.2	12.9	231	Antiope	Herrmann	SX13C	Styx	SF
TT362	glo	85.1	12.2	215	Lottamontee	Herrmann	McDougalls Rd	L. Denison	SF
TT 69	reg	85	17.6	347	Chapel Tree		Skeleton Rd	Styx	SF
TT 01	reg	85	16.1	307	Mifsud Tree	Mifsud	Wayatinah	Derwent	NP
TT324	reg	85	14.1	259	Training Tree	Hickey	Arve Spur 3	Arve	SF
TT278	reg	85	14.1	258		Plumpton		Styx	SF
TT 27	reg	85	14.0	257	Tewson Tree	Mifsud	Andromeda	Styx	SF
TT320	reg	85	12.4	219	Winston Tree	Davies	00012D	Derwent	SF
TT175	reg	85	12.0	208		Plumpton	SX019A	Styx	SF
TT 33	reg	85	10.8	181		Mifsud	Andromeda	Styx	SF
TT 51	reg	85	10.0	163	Perfect Tree	Mifsud	Andromeda	Styx	SF
TT284	reg	85	8.6	132	Sink Hole Tree	Harrison, Herrmann	Lower Coles Ck	Florentine	SF
TT331	reg	85	6.6	91		Clark, Balmer	Upper Cole	Florentine	NP
TT200	reg	83	16.0	301	Gorgeous	Mannes	Wayatinah	Derwent	NP
TT191	reg	82	16.2	346	Still Sorrow	Herrmann	Glow Worm Ck	Florentine	SF
TT 23	reg	82	15.4	283	Wayatinatoo	Mifsud	Wayatinah	Derwent	NP
TT 46	reg	81	14.3	285	Gandalfs Staff	Law, Herrmann	WaterFall Ck Rd	Styx	SF
TT195	reg	80	16.2	296	Leaning Tower Bluespur	Mifsud	1 km El Grande	Derwent	SF
TT 85	reg	79	18.7	439	El Grande	Herrmann	Robinson Ck	Derwent	SF
TT328	reg	79	20.5	402	Big Foot	Mifsud, Greenwood	Arve	Arve	SF
TT198	obl	79	16.0	287		Mannes	Beech Ck	Derwent	NP
TT 19	reg	78	18.6	350	007	Bond	Conways Rd	Arve	SF
TT197	obl	78	16.4	294		Mannes	Beech Ck	Derwent	NP
TT309	reg	73.6	16.7	288	Mnemosyne	Herrmann	SX13C	Styx	SF
TT 38	reg	72	18.2	318	Two Towers	Mifsud	Jacques Rd	Styx	SF
TT275	del	72	17.0	286		Herrmann	SX19A	Styx	SF
TT 43	reg	71	18.2	315	Bell Bottom	Mifsud	Waterfall Ck Rd	Styx	SF
TT 83	reg	70	17.1	283	Roblon	Herrmann	Lower Coles Ck	Florentine	SF
TT 41	reg	65	18.0	289	Methuselah	Mifsud		Styx	SF
TT360	obl	60.9	21.1	341		Clark, Hamilton	Reynolds Falls	NW Tas	NR
TT 40	reg	59	19.0	290	Blue Tier Giant	Nicklason	Blue Tier	NE Tas	SF
TT 22	obl	53	16.9	329	Gothmog	Mifsud	Jacques Rd	Styx	SF

*Abbreviations: reg = *Eucalyptus regnans*; obl = *Eucalyptus obliqua*; glo = *Eucalyptus globulus*; del = *Eucalyptus delegatensis*; vim = *Eucalyptus viminalis*; SF = State Forest; FR = Forest Reserve on State Forest; NP = National Park; NR = Nature Reserve