

STREET TREE TRIALS –AVENUES OF INTEREST

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Introduction:

Brisbane City Council initiated a formal street tree trials program in June 2000 with the selection of an initial five indigenous rainforest species. Now just over three years later, there are seventeen trial species either planted out or in nursery production.

The aim of the trial program is to continue to expand the suite of suitable street tree species for use in creating attractive streetscapes in Brisbane, as well as to showcase the diversity and potential of south-east Queensland's diverse rainforest flora.

Increasing the use of high performing, but uncommon indigenous tree species along Brisbane footpaths which offer striking features in their form, flowers, foliage etc. will hopefully encourage the wider commercial availability of such species, leading in turn to greater use in home gardens for both amenity and biodiversity benefits.

Although, not completely restricted to SEQ rainforest species, the trial program has focussed on them as it is felt there is considerable untapped street potential among their numbers. This is especially so for the species of the dry rainforest scrubs, which can endure harsh growing conditions, not unlike that experienced by street trees.

Species selection

The trial species have been chosen collaboratively from a combination of staff research, other local government plantings in the region, and suggestions from an experienced community rainforest regeneration group in Brisbane, the Brisbane Rainforest Action and Information Network (BRAIN). This group, whose members have been revegetating creeks and rainforest remnant areas in Brisbane for many years, have extensive knowledge and experience in propagating and growing many of the commercially unavailable species which are of interest to this research. Their assistance is invaluable in proving fresh, viable seed for particular hard to get species such as *Dissalaria baloghioides* (Lancewood).

Final species selections are made based on the full spectrum of street tree selection criteria including the species potential to perform well and remain hardy in footpath conditions, good shade cover, attractive flowers, foliage, or bark, a single, straight trunk, strong branch attachment, reasonable lifespan, and ease of propagation. Known undesirable features that would generally exclude species were root issues, suckering, fleshy, thorny or poisonous fruits, excessively slow growth, and severe insect and disease susceptibility.

As there are few existing small and medium height street species in the existing palette whose maximum height will not conflict with overhead powerlines, emphasis was also given to ensuring a number of such species were included in the trials. Some species which had shown good potential in this regard from earlier trials from 12 years ago (eg; *Alectryon connatus*) have also been included.

Final tree heights and canopy dimensions for these species under street conditions are still uncertain for many of these species. Thus estimates of final heights have been scaled down from heights for closed forest grown specimens which are generally much taller and narrower in form.

It was also important to select for a wide variety of tree form, foliage textures, heights, colours, flowers and barks to maximise the choice available for varying site conditions such as narrow/wide footpath widths, road hierarchies, and existing landscape character.

The species chosen to date are:

Year 1 Selected 2000	Year 2 Selected 2001	Year 3 Selected 2002
<i>Streblus brunonianus</i> <i>Elaeocarpus obovatus</i> <i>Rhodospaera rhodanthema</i> <i>Flindersia xanthoxyla</i> <i>Hodgkinsonia ovatiflora</i>	<i>Rapanea variabilis</i> <i>Alectryon tomentosus</i> Dissilaria baloghioides <i>Aphananthe phillipensis</i> <i>Brachychiton discolor</i> <i>Atalaya salicifolia</i>	<i>Alectryon connatus</i> <i>Flindersia collina</i> <i>Flindersia bennettiana</i> <i>Guoia semiglauca</i> <i>Elaeocarpus eumundii</i> <i>Bolusanthus speciosus</i>

The only introduced selection is the species *Bolusanthus speciosus* (Tree Wisteria) with attractive mauve, pea flowers and an interesting bark texture.

Further information on the seventeen trial species is given in Appendix 1.

Methodology:

The field trials consist of a minimum of 100 specimens of each species planted in a variety of footpath conditions across the city using at least 10 specimens in any one site. Sometimes, site constraints or residents objections have resulted in less trees being planted than planned, although commonly 20 –30 specimens are planted. Stock size is usually around 1.1 –1.3 m tall within a 250mm diameter container.

Stock quality is seen to be a critical element, with planting stock contract grown by a nursery contracted to meet Council’s Nursery Stock Standard. Stock is grown at the nursery from seed specifically collected for the purpose by volunteers or nursery staff, or grown on from smaller purchased stock. Planting takes place within either the Council’s “spring planting window” (September-November) or the “autumn planting window” (March-May). Plants are fertilised at planting with Osomocote and thereafter regularly watered, fertilised and weeded at the same frequency as per standard street tree early care practices (ie; a 12 month period consisting of weekly for the first month and then monthly for the next 11 months). An organic liquid fertiliser (Charlie Carp) is added to the water provided at each maintenance visit.

Planting site details and plant dimensions are recorded at planting, and performance is being monitored at present with the assistance of Horticulture students from Grovely TAFE in Brisbane.

Due to inter-specific differences in growth rates and stock availability, as well as linking plantings to seasonal windows, there is considerable variation between species in both the number and timing of their plantings to date. Eight of the seventeen species have been installed since March 2001, with the last planting in November 2002.

Table 1: List of trial species planted out as of August 2003

Numbers planted	Botanical name	Common name	No. sites established
173	<i>Rhodosphaera rhodanthema</i>	Tulip Satinwood	11
220	<i>Flindersia xanthoxyla</i>	Yellow Wood	15
129	<i>Streblus brunonianus</i>	Whalebone Tree	5
62	<i>Hodgkinsonia ovatiflora</i>	Golden Ash	3
28	<i>Elaeocarpus obovatus</i>	Hard Quandong	2
48	<i>Alectryon tomentosus</i>	Hairy Bird's eye	1
40	<i>Rapanea variabilis</i>	Muttonwood	1
75	<i>Brachychiton discolor</i>	Lacebark	4

Results:

Performance data from all sites is to be provided to Council by the TAFE students shortly.

In the interim, some preliminary data has been collected by Council staff from a subset of existing sites. Where specimens are less than 12 months old, growth data since planting has been extrapolated to an annual figure.

The latter records have provided the following growth data:

Table 2: Average annual growth rate comparisons of trial species as at August 2003

Species	Minimum average growth rate (m/yr) recorded at a site	Maximum average growth rate (m/yr) recorded at a site	No. of sites measured
<i>Rhodosphaera rhodanthema</i>	.45	.91	3
<i>Alectryon tomentosus</i>	-	.40	1 *
<i>Elaeocarpus obovatus</i>	.26	.33	2
<i>Brachychiton discolor</i>	.20	.33	2
<i>Hodgkinsonia ovatiflora</i>	.26	.29	2
<i>Streblus brunonianus</i>	.26	.28	2
<i>Rapanea variabilis</i>	-	.26	1 *
<i>Flindersia xanthoxyla</i>	.07	.23	5

- This species has only been planted at one site to date.

In reviewing species performance to date, the findings must be viewed in the context of the very dry conditions experienced in Brisbane during the period between March 2001 and the present when the plants were installed and becoming established.

Bureau of Meteorology data for Brisbane for that period reveals that in the first summer following the initial plantings, (the months of December 2001 and January/February 2002), the average summer rainfall in Brisbane was only 229mm, which is 52% of the average annual rainfall for that period (442mm). The following summer of December 2002 and January/February 2003 was 335mm, being 76% of the average summer rainfall.

Rainfall was lower overall throughout the year also. In 2001, the entire annual rainfall for Brisbane was 961mm, (being 80% of the annual average rainfall figure of 1204mm), and 2002 drier still with 741mm (only 62% of the average).

The year 2003 to date has also been below average, with only 77% of the average rainfall received for the months of January to July.

General findings to date are as follows:

- *Rhodosphaera rhodanthema* (Tulip Satinwood) has performed the best in terms of growth rate of all eight species planted so far, with an annual height increase of between .47m/yr and .91m/yr. It also has the appeal of glossy largish leaves with a red flush in the new growth. It is subject to some minor insect attack, but this does not appear to have an impact on general tree health and performance.

The species is performing best at present on two sites on sandy loam soils, although good results are still found on a heavier clay soil as well. pH ranges are from 6.8 to 7.

Some young specimens are demonstrating a juvenile structural issue with multiple, crowded branches arising from the one point on the trunk.

- The single planting of *Alectryon tomentosus* (Hairy Bird's eye) planted in November 2002 is performing uniformly well in an exposed, windy median environment. This species is possibly the second best performing species at present, after *Rhodosphaera rhodanthema*.

After only 9 months in the ground, the trees appear to be growing quite vigorously at 0.4m/yr with the added appeal of reddish- bronze new growth. This species is from the very hardy family Sapindaceae, which boasts some of the best performing native Brisbane street tree species such as *Harpullia pendula* (Tulipwood) and *Cupaniopsis anacardioides* (Tuckeroo). (Interestingly, three other species of the seventeen trial species are also from the Sapindaceae family (*Guioa semiglauca*, *Atalaya salicifolia* and *Alectryon connatus*).

Ripening fruit is evident on approximately 15% of specimens. Expected to grow to approximately 8 metres, it has a rounded, shady canopy.

- *Elaeocarpus obovatus* (Hard Quandong) was expected to be slower growing in comparison to others, but to be a hardy species. This is based on previous cultivation knowledge in garden and park plantings. While growth rates have been reasonable (.26m/yr and .33m/yr), performance in general at the two existing plantings (May 2002 and November 2002) has been affected by maintenance problems. Further plantings of this species at a number of sites are planned in spring 2003, and it will be interesting to compare their performance with existing plantings.

As at all sites, where residents are providing care to specific trees outside their properties, performance is considerably better. This species often occurs naturally along creeklines in Brisbane and is likely to perform best on sites with good moisture. At least two other species of this genus are popular landscape choices in Brisbane, *Elaeocarpus reticulatus* (Blueberry Ash) and *Elaeocarpus obovatus* (Blue Quandong). A third, *Elaeocarpus eumundii* (Eumundii Quandong), has now also been selected for trialling following good performance elsewhere. It bears masses of tiny white flowers and attracts birds to its blue fruits.

A considerable variability in form and leaf size amongst specimens in this species was noted at all sites.

- *Brachychiton discolor* (Lacebark) is a very large ornamental tree with attractive pink star shaped flowers. A popular related species used in ornamental plantings in Brisbane is the Flame Tree (*Brachychiton acerifolius*). It appears to be performing quite well with growth rates of .20m/yr and .33m/yr at the two assessed sites. Some insect attack is evident on the leaves at both sites, but does not appear to be affecting vigour. This species has quite a thick trunk as a mature tree and is selected for wider footpaths only.
- *Hodgkinsonia ovatiflora* (Golden Ash) is one of the small to medium height species with a rounded canopy and small glossy leaves, selected also for its potential use under powerlines. Whilst not growing rapidly to date, the two sites recorded are demonstrating acceptable growth of .26m/yr and .29m/yr, and reasonable health and vigour. There appears to be slightly better performance on more sheltered locations within sites. However, a third planting has performed extremely poorly, with nearly all specimens stunted with yellowed, sparse foliage and many virtually leafless specimens. (The growth data for this site cannot be estimated as the average height at planting was not available). The reasons for this result will be investigated further. The oldest plantings are approximately 21 months.
- There was variable performance evident between individual *Streblus brunonianus* (Whalebone Tree) specimens. The best performing specimens demonstrate dark green, dense, healthy growth, and often appear to be those receiving additional water and mulch from adjacent businesses or residents in the post maintenance period. By comparison, others in the same street, often without this extra care have generally sparser foliage and slower growth rates, although in most cases are still acceptable performers. A number of specimens under stress are exhibiting yellowing of leaves, reduced leaf size and leaf drop. The species appears to be performing fairly well the same at both sites, with one site being a clay loam and the other a sandy loam. pH values at the sites measured were around 6.8 – 7.

In their initial years, it is observed at both sites that in street plantings at least, this species seem to concentrate most biomass increase into bushy lateral growth. The average annual height increase is between .26m/yr and .28m/yr. Small yellow fruit attractive to birds, was observed on two year old specimens. This species holds promise for use under powerlines if successful. A specimen cultivated in a Brisbane home garden is 4 metres high after nine years and with a dense bushy habit and attractive dark green serrated foliage.

- *Rapanea variabilis* (Muttonwood) is another of the lower growing species, possibly growing to 6m, with attractive glossy, oblanceolate leaves and rust coloured new growth flushes. Only one planting has occurred to date (November 2002), with specimens so far appearing to be performing acceptably well on average (.26m/yr), with good form and vigour. Many specimens were observed to be in flower over the winter period, with small cream flowers borne directly on the woody stems.
- *Flindersia xanthoxyla* (Yellow Wood) is a tall spreading species which has been observed as an attractive amenity tree in park and golf course settings. In the trials on a range of soil types, it appears to be a generally slower growing tree compared to the other species, with an average annual height increase ranging between .07m/yr and .23m/yr between sites. The three remaining sites all recorded average growth rates of 0.14m/yr. As for *Streblus brunonianus*, specimens appear to be struggling where additional water and

mulch have been limited after the conclusion of the establishment maintenance. A quality issue affecting a limited number of stock may be contributing to poor performance in some earlier plantings.

The remainder of the Year 2 species, together with one of the Year 3 species are scheduled for planting this spring:

- *Dissilaria baloghioides* (Lancewood)
- *Aphananthe phillipinensis* (Native Elm)
- *Atalaya salicifolia* (Scrub White Wood)
- *Alectryon connatus* (no common name)

Planting of all Year 3 species is expected to be complete by autumn 2004.

As a new element to the trials program in 2003, Energex, the authority responsible for the power distribution network in SEQ, has provided a selection of grafted *Brachychiton* cultivars to Brisbane City Council for inclusion in the trial program.

Four cultivars have been provided by Energex for trialling to assess their performance as ornamental, lower growing species under powerlines. In May 2003, twenty five specimens of the four cultivars were planted and their progress will be now monitored as part of the overall program.

Conclusion

It is anticipated that it may take up to five years or even longer to determine the true potential of many of these species as suitable street trees in Brisbane.

Species which prove successful in these Brisbane trials could be expected to perform comparably from the north coast of New South Wales through to the Sunshine Coast.

This trial work is planned to continue for the foreseeable future as an integral part of Brisbane City Council's overall street tree management program.

It is expected there are still many more potentially successful street tree species to be found amongst the diverse rainforest flora of South East Queensland, and enormous benefit to be gained from exchanging information with other Councils undertaking similar investigations.

Appendix 1 General Information on Street Tree Trial Species

Year 1 Species

Species	General Description (ht, spread, foliage, flowers)	Tolerances/ Resistance	Wood Qualities	Lifespan	Other comments
1. <i>Streblus brunonianus</i> Whalebone Tree (Moraceae)	Small to medium size tree of dry rainforest which grows to approx 4 –6 metres in cultivation. Has an upright columnar to rounded dense canopy with thin, dark-green serrated lanceolate to ovate foliage which are lightly sandpaperish to the touch (3 - 8cm long x 3cm wide). Flowers insignificant, fruit a small yellowish 5mm berry –Closely related to Sandpaper Fig and Rough-leaved Elm	Known to look good even after being neglected	Extremely tough and flexible timber. Called Whalebone Tree because stiff tough timber used to make women's corsets	Unknown but not shortlived	Trees may be seen in the wild at Rafting Ground Reserve Propagation from cuttings Useful shade tree Possible application under powerlines
2. <i>Elaeocarpus obovatus</i> Hard Quandong (Elaeocarpaceae)	Bushy tree to > 10m tall in the wild (likely to be only 6-8m in cultivation) with elliptical leaves 10cm x 3.5 cm. Naturally occurs along Brisbane creeklines, Becomes covered in sprays of tiny white bell flowers in spring that are highly scented and followed by attractive round blue berries. Slow to reasonable growth rates in cultivation. Like moisture. Slight buttressing at base in older specimens.	Adaptable to wide range of situations and soil types. Likely tolerant of wet soils and shade	White, hard & Used in making and furniture	Longlived Remnant specimen in Rotary Park, cnr Graham Rd & Gympie Rd, Carseldine considerable age - 10m high	Birds are attracted to fruit Cultivated specimen at entrance to Downfall Creek Bushland Centre, McDowall Seed difficult to propagate Not commonly available
3. <i>Rhodophaea rhodanthema</i> Tulip Satinash (Anacardiaceae)	Medium sized fast growing tree to probably 8-10m in cultivation) with pinnate lanceolate leaflets to 7cm long. Bears sprays of red small flowers in spring followed by bunches of glossy brown dry berries 1.2cm in diameter that tend to remain on the tree. Male and female trees.	BRAIN members reckon insect attack may be problem in young specimens occasionally but doesn't affect tree	Moderate hardness	Longlived	Beautiful foliage plant Highly ornamental species Semi-mature specimens at Kevin Daley's Nursery, Belmont
4. <i>Flindersia xanthoxyla</i> Yellow Wood or Long Jack (Rutaceae)	Large straight tree up to 15m high in cultivation (>20m in the wild) developing spreading canopy. Deep green thin leaves; pinnate 75cm long with 4 –11 lanceolate leaflets each to 10cm long. Bears small yellow flowers in terminal clusters followed by oblong woody brown 7-10cm pods covered with small prickles	Tolerates heavy shade	Strong durable timber	Long lived	Attractive foliage and useful shade tree. Propagate from fresh seed. Easy to grow.
Species	General Description (ht, spread, foliage, flowers)	Tolerances/ Resistance	Wood Qualities	Lifespan	Other comments
5. <i>Hodgkinsonia oxatiflora</i> Golden Ash (Rubiaceae)	Small to medium sized tree to possibly 6m in cultivation with rounded canopy . Flowers insignificant followed by masses of black berries 0.5 cm wide.	Quite tough but probably prefer better sites	Unknown	Long lived	Birds just love fruits. Berries on ground not a problem underfoot –not mushy. Possible application under powerlines

Year 2 species

Species	General Description	Tolerances / Resistances	Wood Qualities	Lifespan	Specimen location	Other comments
1. <i>Rapanea variabilis</i> Muttonwood (Myrsinaceae)	Small tree to 6 m with thick stiff and glossy oblanceolate leaves 3 – 10cm long. Bears small cream flowers in clusters on old wood followed by small blue fruits	Hardy	Fairly tough?	Unknown but not short lived	Unknown	Attractive foliage, Propagation from cuttings or seed, Comparable to size and shape of <i>Pittosporum rhombifolium</i>
2. <i>Alectryon tomentosus</i> Hairy Bird's Eye (Sapindaceae)	Small tree of dry rainforest with rounded canopy to 6-8 m high with compound leaves 5- 12cm long with serrated hairy leaflets. Produces black seeds embedded in red aril. Smooth grey trunk. Flowers insignificant.	Hardy	Tough	Unknown but not short lived	Mature specimen growing at 41 Loch St West End on fenceline in front yard.	Attractive foliage
3. <i>Dissiliaria baloghioides</i> Lancewood (Euphorbiaceae)	Medium rainforest tree with cylindrical shape to 8m in cultivation. Leaves glossy, elliptical or ovate 6-11cm long. Brown bark shed in strips.	Unknown	Hard	Long lived	Mature specimens in Bancroft Park.	Very tough tree and extremely ornamental with deep pink flushes of new growth appearing like flowers.
4. <i>Aphelandra philippinensis</i> Native Elm (Ulmaceae)	Small to medium tree to 8m with dark green foliage. Grows along creek flats but will grow on hillsides also. Clear trunk and dense lollypop canopy. Very ornamental trunk with flanges and scaly bark	Unknown but likely to be very hardy	Tough	Unknown	Unknown	
5. <i>Brachychium discolor</i> Lacebark (Sterculiaceae)	Medium to large tree with thick trunk to possibly 10 –15m in cultivation Becomes covered in pink bell shaped flower in clusters from Nov –Jan.	Hardy in most situations and heavy soils and responds to fertiliser when young	Unknown	Not shortlived	Small older specimen in garden bed of Suncorp –Metway building at corner of Turbot and Upper Albert Sts.	Very large tree with stout trunk; Needs very wide footpaths; Will drop leaves regularly; Flowers heavily in dry years
6. <i>Atalaya salicifolia</i> Scrub White wood (Sapindaceae)	Small to medium tree of dry rainforest (6- 8 m high). Moderately fast growth rate. Not seen open grown but likely to be more columnar than rounded	Supertough –could take all sites except wet feet	Hardy?	Long lived	Unknown - ask Kenneth McClymont X71489	Fairly ornamental tree with great toughness with decent shade

Year 3 species

Species	General Description	Tolerances/Resistances	Wood Qualities	Lifespan	Specimen location	Other comments
<p><i>1. Alectryon connatus</i></p> <p>(no known common name)</p> <p>(Sapindaceae)</p>	<p>Small tree to medium sized tree 6-8m with glossy pinnate leaves</p> <p>Bears small cream flowers in spring followed by black seeds with red aril in summer-autumn.</p>	Hardy	Fairly tough?	Unknown but not short lived	Some attractive street tree specimens in Lawson St, Morning side planted in 1989 now approximately 4m tall	Possible application as species under wires. The genus is known generally to be hardy.
<p><i>2. Flindersia collina</i></p> <p>Leopard Ash</p> <p>(Rutaceae)</p>	<p>Medium columnar tree to 25m in wild in dry rainforest. Likely to be much smaller, 10-12 in cultivation. Pinnate glossy, dark green leaves.</p> <p>Whiter clusters of flowers in spring followed by woody pods in late summer</p> <p>Slower growing species with dense foliage</p>	Fairly hardy	Unknown	Unknown but not short lived	Species planted in Ison St, Morningside in 1989 under wires	<p>Attractive spotted grey and cream bark. Species was planted in 1989-1990 trials but very few specimens only</p> <p>Will grow on poorer soils</p>
<p><i>3. Flindersia bennettiana</i></p> <p>Bennett's Ash</p> <p>(Rutaceae)</p>	<p>Large, dense foliated tree to 40m in wild, likely to be much smaller, around 15m in cultivation. Glossy dark green pinnate leaves. Cream, strongly scented flowers in spring followed by woody dark brown pod in summer.</p>	Hardy in many site conditions	Unknown	Unknown but not short lived		<p>Can be slow growing. Can be affected by sooty mould</p> <p>Is grown as far south as Melbourne</p>
<p><i>4. Guoia semiglauc</i></p> <p>Wild Quince</p> <p>(Sapindaceae)</p>	<p>Rounded, medium sized tree to 10m with pinnate leaves; dark green above and grey below. Flowers not significant. Ornamental in appearance</p> <p>A common fast growing species of rainforests</p>	Unknown but likely to be very hardy	Tough	Unknown		
<p><i>5. Elaeocarpus eumundii</i></p> <p>Eumundi Quandong</p> <p>(Elaeocarpaceae)</p>	<p>Large decorative tree > 10m with open canopy and dark green foliage. New growth orange and ends of branches.</p> <p>Masses of dainty white flowers in summer followed by 1.5cm blue fruits</p>	Hardy in most situations	Unknown	Unknown	Nice 12 year old specimen in carpark on Old Gympie rd, Kallangur	
<p><i>6. Bolusanthus speciosus</i></p> <p>Wild Wisteria</p> <p>(Fabaceae)</p>	<p>An ornamental deciduous tree to 6m with open canopy and attractive sprays of mauve, wisteria-like flowers.</p>	<p>Prefers light to medium well drained soils</p> <p>Frost resistant</p>	Unknown	Unknown but not short lived	Attractive specimens growing in Robinson Rd, Geebung planted in 1989	May not be very tolerant of drought conditions