Brisbane Street Tree Trials Program

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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 sixteen trial species 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 also 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 necessarily restricted to SE Qld rainforest species, the trial program has focussed on this group 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 remnant rainforest 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 has been invaluable also in proving fresh, viable seed for particular hard to get species such as *Dissiliaria 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* (Grey Bird's Eye) were also 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**
Streblus brunonianus *Elaeocarpus obovatus* *Rhodosphaera rhodanthema* *Flindersia xanthoxyla* *Hodgkinsonia ovatiflora*	*Rapanea variabilis* *Alectryon tomentosus* *Dissiliaria baloghioides* *Aphananthe philippinensis* *Brachychiton discolor* *Atalaya salicifolia*	*Alectryon connatus* *Flindersia collina* *Flindersia bennettiana* *Guoia semiglauca* *Elaeocarpus eumundi*

Methodology:
The field trials aim to establish a minimum of 100 specimens of each species 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 have been planted of each so far. Stock size is usually around 1.1 – 1.3 m tall in 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. Fifteen of the sixteen species have been installed since March 2001, with the latest plantings in March 2004.

Table 1: List of trial species planted out as of June 2004

Numbers planted	**Botanical name**	**Common name**	**No. sites established**
173	*Rhodosphaera rhodanthema*	Tulip Satinwood	11
173	*Flindersia xanthoxyla*	Yellow Wood	12
135	*Streblus brunonianus*	Whalebone Tree	6
76	*Hodgkinsonia ovatiflora*	Golden Ash	3

78	*Elaeocarpus obovatus*	Hard Quandong	4
105	*Alectryon tomentosus*	Hairy Bird's eye	4
84	*Rapanea variabilis*	Muttonwood	5
125	*Brachychiton discolor*	Lacebark	5
25	*Atalaya salicifolia*	Scrub White Wood	1
139	*Dissilaria baloghioides*	Lancewood	7
40	*Aphananthe philipinensis*	Native Elm	2
126	*Flindersia bennettiana*	Bennett's Ash	6
92	*Flindersia collina*	Leopard Ash	6
65	*Alectryon connatus*	Grey Bird's Eye	4
115	*Guoia semiglauca*	Wild Quince	3

Results:
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 last field recordings taken in late 2003 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
Rhodosphaera rhodanthema	.45	.91	3
Alectryon tomentosus	-	.40	1
Elaeocarpus obovatus	.26	.33	2
Brachychiton discolor	.20	.33	2
Hodgkinsonia ovatiflora	.26	.29	2
Streblus brunonianus	.26	.28	2
Rapanea variabilis	-	.26	1
Flindersia xanthoxyla	.07	.23	5

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 insect attack, but this does not appear to have had 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 on sites 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*. 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) is fair only. Further plantings of this species have occurred since these recordings, and it will be interesting to compare their performance with these 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 grandis* (Blue Quandong). A third, *Elaeocarpus eumundi* (Eumundi Quandong*),* has now also been selected for trialling following good performance elsewhere, and is expected to be planted out in spring 2004. It shows attractive bronze-red new foliage, and bears masses of tiny white flowers.

  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 reasons for this result will be investigated further.

- 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 variablis* (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 16 trial species, with the exception of *Elaeocarpus eumundii* were planted out in the summer-autumn 2004 period:

- *Dissiliaria baloghioides* (Lancewood)
- *Aphananthe philippinensis* (Native Elm)
- *Atalaya salicifolia* (Scrub White Wood)
- *Alectryon connatus* (Grey Bird's Eye)
- *Flindersia bennettiana* (Bennett's Ash)
- *Flindersia collina* (Leopard Ash)
- *Guoia semiglauca* (Wild Quince)

As a new element to the trials program in 2003, Energex, the authority responsible for the power distribution network in SEQ, 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.

Acknowledgments

I would like to acknowledge the invaluable assistance of Kenneth McClymont, Shealagh Savage and the other dedicated members of the Brisbane Rainforest Action & Information Network (BRAIN) in providing both species information and seed collection used in the street tree trials program.

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