

Brachychiton guymeri J.A.Bever., Fensham & P.I.Forst. (Sterculiaceae), a new species from north Queensland

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Summary

Fensham, R.J., Beveridge, J.A. & Forster, P.I. (2019). *Brachychiton guymeri* J.A.Bever., R.J.Fensham & P.I.Forst. (Sterculiaceae), a new species from north Queensland. *Austrobaileya* **10(3)**: 443–457. The new species *Brachychiton guymeri* is described and illustrated from north Queensland and is thought to be related to *B. bidwillii* F.Muell. *Brachychiton guymeri* is known from two populations in dry rainforest or amongst rainforest elements in grassy savanna with high rock cover and has a current conservation status of Endangered. Fifty three dry rainforest patches were searched within 50 km of the original two locations but no new populations were located. The species is represented by a broad spectrum of size-classes in dry rainforest but in savanna, fire can ‘top-kill’ larger plants resulting in a high density of small stems emanating from coppice. A revised conservation status of Vulnerable is recommended.

Key Words: Sterculiaceae, *Brachychiton*, *Brachychiton bidwillii*, *Brachychiton guymeri*, *Brachychiton* sp. (Blackwall Range R.J.Fensham 971), Australia flora, Queensland flora, new species, taxonomy, conservation status

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Introduction

Brachychiton Schott & Endl. is a genus of some 36 species in the family Sterculiaceae, consisting of predominantly dry season deciduous trees and shrubs found across northern and eastern Australia, and New Guinea (Guymer 1988). *Brachychiton* includes the iconic ‘bottle-trees’ with swollen trunks and are commonly cultivated ornamental plants with attractive bell-shaped flowers. Additionally, the trunks and leaves of several species are also utilised to provide fodder for livestock in dry periods.

This paper provides a taxonomic description of the new species *Brachychiton guymeri* J.A.Bever., Fensham & P.I.Forst. (previously *B.* sp. (Blackwall Range R.J.Fensham 971), and identifies characters that distinguish it from previously described species. *Brachychiton guymeri* is known from two populations south-east of Collinsville. The larger population (Blackwall Range) occurs in fragmented dry rainforest on a boulder

field and the smaller population (Aureole) was located where elements of dry rainforest occur within savanna on an unnamed geological feature forming an aureole with an inner diameter of approximately 3 km. These two populations are 10 km apart. The association of this new species to dry rainforest patches is significant in relation to the speciation hypothesis that we present in this paper, so a short overview of the ecology of this vegetation type is given to provide context.

In broad terms the vegetation of northern Australia can be separated into savanna, which is fire-prone and adapted to recover after fire, and fire-sensitive rainforest, which excludes fire (Bowman *et al.* 2010; Fensham 2012; Murphy & Bowman 2012; Ondeï *et al.* 2016). The undescribed *Brachychiton* species was first discovered in December 1992 during an extensive survey of dry rainforest (Fensham 1995). Dry rainforest describes vegetation found in seasonally dry areas which share structural, floristic and ecological affinities with mesic rainforest (Fensham 1995). In northern Australia, dry rainforest is widely distributed, though generally as

small, highly fragmented patches, occurring predominantly in Queensland and the Northern Territory, but also extending into Western Australia and New South Wales. Dry rainforest can occur in areas with as little as 500 mm annual precipitation (Russell-Smith 1991; Fensham 1995); however, as rainfall is reduced, so too is frequency of occurrence, patch size and tree species diversity (Fensham 1995). As for mesic rainforest, dry rainforest is characterised by a closed canopy of mixed species, lack of ground fuels and the prevalence of vines and epiphytes (Fensham 1995). Dry rainforest communities have a much higher proportion of deciduous and semi-deciduous species (Gillison 1987) but are ecologically similar to mesic rainforest in relation to fire sensitivity and suppression (Fensham 1995), achieved by shading out potential ground fuel and the creation of a cool, moist microclimate (Russell-Smith & Setterfield 2006; Ondeï *et al.* 2016).

In a flammable landscape dominated by savanna, dry rainforest predominantly occurs in areas which are topographically fire protected or where a rocky substrate prevents fuel load accumulation (Russell-Smith 1991; Fensham 1995). This sensitivity however, does not mean they are unable to survive individual fires, with basal and aerial resprouting observed in some species (Ondeï *et al.* 2016), nor does it preclude expansion into savanna ecosystems with fire protection (Fensham & Butler 2004).

The paper aims to develop an understanding of the distribution and ecology of the newly described species, in order to review the threat status of the species using IUCN (2017) Red List criteria.

Taxonomy of the genus *Brachychiton*

Brachychiton is characterised by woody dehiscent cymbiform follicles and can be separated from the related genus *Sterculia* L. by its hirsute exotestas which remain in the follicle after the seeds are dispersed (Guymer 1988). Distinguishing characters at the subgeneric and species level include flower colour and size, perianth shape, androgynophore dimensions, inflorescence

characteristics, follicle shape and size, indumentum characteristics, nectary characteristics, and leaf blade shape and size. Most species in the genus exhibit variation in leaf shapes at different life and seasonal stages.

Brachychiton comprises five sections (Guymer 1988), consisting of *B.* section *Oxystele* Guymer (two species), *B.* section *Poecilodermis* Endl. (three species), *B.* section *Delabechea* (Mitchell ex Lindley) Guymer (two species), *B.* section *Trichosiphon* (Schott & Endl.) Endl. (four species) and *B.* section *Brachychiton* (25 species). This tally includes the recently described *B. chrysocarpus* Cowie & Guymer (Cowie & Guymer 2014), the new species described here and another three undescribed species known by informal names.

Materials and methods

Morphological description

The undescribed *Brachychiton* species was described using previously defined characters (Guymer 1988) based on specimens from the Queensland Herbarium, and supplemented by field collection and observation. The most morphologically similar species were identified and distinguishing characteristics established.

Survey for extent of occurrence

This was achieved by mapping the distribution of potential suitable habitat, searching for populations, assessing the size and demographics of the known populations, identifying distribution and structural variation between habitats, and evaluating possible threats.

In order to search for further populations all patches of dry rainforest were mapped within 50 km of the original site, excluding areas with greater than 900 mm of annual precipitation, using 2.5 m SPOT imagery available through World Imagery (<http://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9>) at a scale of 1:100 000 with a minimum patch size of 0.1 ha. Dry rainforest is characterised by a diverse tree layer and low grass cover and

can be identified from satellite imagery using combinations of closed canopy, heterogeneous canopy texture and exposed rock. The patches of rainforest with greater than 900 mm rainfall were excluded because it has been established that the floristic composition of rainforest is strongly related to mean annual rainfall (Webb *et al.* 1984; Fensham 1995). On this basis it was assumed that search effort for a dry season deciduous tree is best expended in rainforest of relatively low rainfall areas. Within the search area, 53 patches were surveyed to search for the target species with 25 surveys conducted in 1993 and 28 in 2017.

Population surveys

The sites where the target species was located were mapped at 1:4000 to differentiate dry rainforest habitat (devoid of grass), boulder fields devoid of vegetation and savanna (grassy) (**Fig. 1**).

In March 2017, 6 m wide plots with variable length were randomly distributed within the dry rainforest and savanna (greater than 1% grass cover) within the populations. Grass cover was determined by counting intercepts of grass (assessed as minimum convex polygons around tussocks) at 1 m intervals along the centre of the plot. In each plot individuals of *B. guymeri* were also counted and assigned to size categories: < 0.5 m tall; 0.5–2 m tall; > 2 m tall, < 5 cm DBH; > 2 m tall, > 5cm DBH.

Mean and standard error densities were determined for each size category within the dry rainforest and savanna types at both sites. The mean values were multiplied by the habitat area to estimate the total number of individuals at each site.

The fire history of the two sites was obtained from the landholders. There was no record of any fire recently at the Blackwall Range site, with fire breaks established on either side of the hill on which it is located. The Aureole population was subject to a fire in 2015, 2–3 years before the survey was conducted.

The potential impact of fire was assessed by evaluating the differences in the sized-

class structure of the stands between dry rainforest (fire protected) and savanna (not fire protected).

Extent of occurrence (EOO) and Area of occupancy (AOO) were calculated according to the IUCN recommendations (IUCN Standards and Petitions Subcommittee 2017).

Germination

Seeds collected from the target species in the field were germinated at the Queensland Herbarium in Brisbane, Australia. Sterilised 5 cm deep seed trays were filled with perlite, with a small amount of peat moss added. Seeds were evenly dispersed, and gently depressed to a depth of *c.* 0.5 cm and the trays lightly topped with vermiculite.

Results

Morphological description

Among the 32 previously described species of *Brachychiton*, six species from the section *Brachychiton* with morphological similarities to the undescribed *Brachychiton* species (< 5 m tall; **Fig. 2A**) were selected for comparison (**Table 1**). *B. guymeri* shares a multi-stemmed habit (**Fig. 2A**) with three other species (**Table 1**). All six of the shrub-form species have a 1:1 ratio between length and width of leaves, whereas *B. guymeri* has leaves on average 1.5 times longer than they are wide (**Fig. 3**). *B. guymeri* tends to have singular flowers, or occasionally small inflorescences of two or three flowers (**Fig. 2B**), compared to related species with inflorescences containing at least three, but usually 7–30 flowers. *B. guymeri* has smooth, glabrous follicles (**Fig. 2C**) compared to *B. chrysocarpus*, *B. bidwillii* Hook., *B. megaphyllus* Guymer and *B. multicaulis* Guymer with dense hair covering the outer surface, and *B. multicaulis* and *B. tuberculatus* (W.Fitzg.) Guymer having a tuberculate surface. *Brachychiton vitifolius* (F.M.Bailey) Guymer can be distinguished by its distinctly impressed adaxial veins and sparse indumentum, compared to the raised veins and dense indumentum of *B. guymeri*. Of the shrub species only *B. bidwillii*, *B. guymeri* and *B. vitifolius* occur in Queensland.

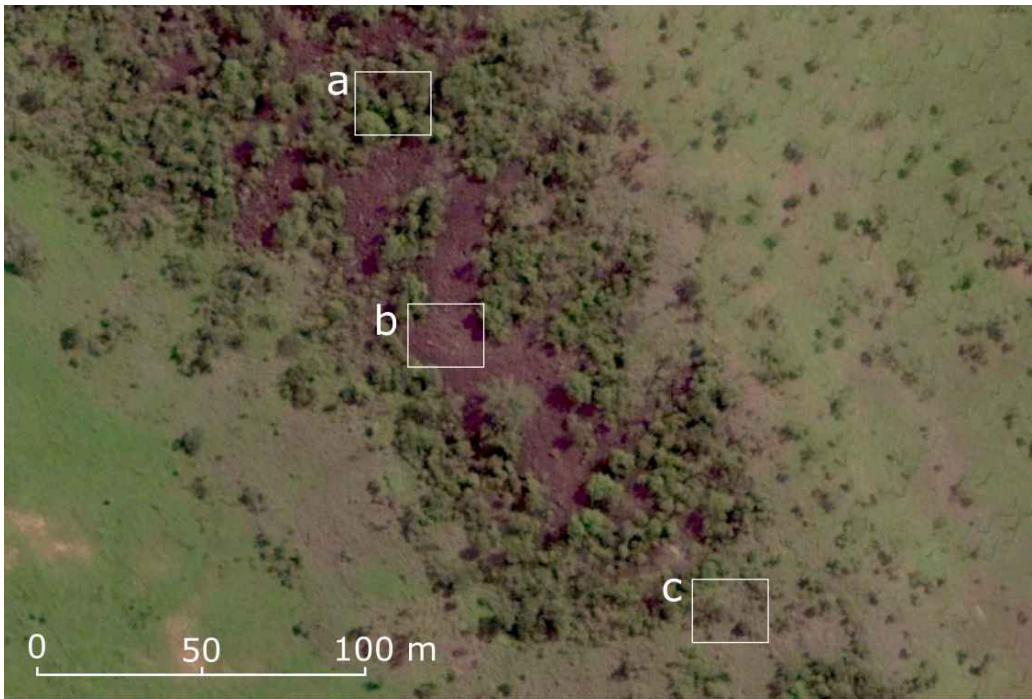


Fig. 1. The three types of habitat that were mapped at the sites where *Brachychiton guyeri* occurs. A dry rainforest habitat, B boulder field devoid of vegetation, C grassy vegetation.

Taxonomy

Brachychiton guyeri J.A.Bever., Fensham & P.I.Forst. **sp. nov.** Similar to *B. bidwillii*, but differing in the follicle exterior being near glabrous with a dark brown surface (versus khaki stellate-scabridulous outside), singular flowers (versus ramal inflorescences, mostly botryoids, ultimate branches usually triads, 7–12(–35) flowered), non-protruding androgynophores (versus androgynophores protruding above tubular opening), white to cream stigmas (versus pink) and floral tube interior densely stellate-hirsute (versus glabrous or occasionally with scattered stellate hairs). **Typus:** Queensland. SOUTH KENNEDY DISTRICT: Exmoor, 6 June 1996, *P.I. Forster PIF19190* & *M.C. Tucker* (holo: BRI [AQ0603172 comprising 3 sheets, carpological and spirit samples]; iso: CNS, K, L, MEL, NSW *distribuendi*).

Brachychiton sp. (Blackwall Range R.J. Fensham 971); Guymer (2017).

Shrub or *tree* to 6 m, single or multi-stemmed (especially regrowth), deciduous. Fissured bark, dark to light grey. Branchlets 1.2–2.2 mm diameter, dense stellate-puberulent. *Leaves* ovate, entire or 3 lobed, 2.2–8.4 cm long, 0.8–6 cm wide, lobes 1–4 cm long; apices obtuse, occasionally retuse, acute, bases shallowly cordate to rounded; mid-dense stellate-hirtellous above and below, with glandular hairs between veins, adaxial veins dense stellate-hirtellous, abaxial veins dense pubescent. *Stipules* *c.* 3.5 mm long, dense stellate-puberulent. *Inflorescences* unknown, flowers only observed singularly. *Bracts* caducous (*n.v.*); pedicels *c.* 7 mm long. *Perianth* tubular-campanulate, 2.4–3.3 mm long, 2.3–3 mm diameter, shortly 5-lobed for *c.* 1/5 of its length, dark pink to

Table 1. Some characters used to distinguish *Brachychiton guymeri* from other closely related *Brachychiton* species, limited to those which form shrub habits. Summarised from Guymner (1988) and Cowie & Guymner (2014).

<i>Character</i>	<i>B. guymeri</i>	<i>B. bidwillii</i>	<i>B. vitifolius</i>	<i>B. megaphyllum</i>	<i>B. multicaulis</i>	<i>B. tuberculatus</i>	<i>B. chrysocarpus</i>
Multi-stemmed habit	Yes	Yes	Yes	No	Yes	No	No
Size ratio of leaf lamina (Length:width)	3:2	1:1	1:1	1:1	1:1	1:1	1:1
Flowers per inflorescence	1 (rarely 2+)	7–12(–35)	8–20	(8–)10–30	7–30	3–7	~24
Perianth exterior indumentum	stellate puberulent	stellate hirtellous	stellate and glandular tomentose	stellate hirtellous	tomentose or hirtellous	stellate hirtellous	dense, stellate, 0.7–1.1 mm
Perianth interior indumentum	stellate hirsute	glabrous, lobes stellate tomentose	sparsely glandular puberulent	stellate tomentose	stellate tomentose	stellate hirtellous	dense, stellate, 0.7–1.1 mm
Stigma colour	white to cream	pink	pink	cream or red	cream to orange-red	cream or red	cream
Follicle exterior surface	dark brown glabrous	khaki stellate-scabridulous	sparsely stellate hirtellous, glabrescent	densely yellow-brown stellate-hirtellous	densely brown stellate-hirtellous	brown stellate hirtellous outside, glabrescent, tuberculate	golden to dark brown densely pubescent
Multi-stemmed habit	Yes	Yes	Yes	No	Yes	No	No

red, occasionally with white, green at base of exterior, white to green interior base, induplicate areas pink; mid-dense to dense at base puberulent exterior, stellate hirsute interior; lobes semi-elliptic to elliptic, obtuse mucronate, recurved. *Nectaries* distinct, 10, 2 opposite each perianth lobe. *Male flowers*: androgynophore white, *c.* 1.8 mm long, obclavate, singular hairs along upper to densely stellate-hirsute base, fertile zone *c.* 4 mm long, 20 stamens, anthers *c.* 2 mm long. *Female flowers*: apparently of similar dimensions. *Follicles* ellipsoid, stipitate, rostrate, 6–9 cm long, 2–4 cm wide, dark brown, glabrous exterior, interior densely stellate-hirsute; pericarp 1.5–3 mm thick; stipes twisted, 15–26(–30) mm long, 4–7.5 mm diameter; apices triangular, arcuate, acute, erect or incurved, occasionally slightly recurved 6–11(–15) mm long. *Seeds* *c.* 14 per follicle, oblong-ovoid, 8.6–12 mm length, 4–9.5 mm diameter. Seedlings with cryptocotylar germination. **Figs. 1A–F.**

Additional specimens examined: Queensland. SOUTH KENNEDY DISTRICT: SE of Mount Leslie, Dec 1992, *Fensham 444* (BRI); Blackwall Range, Exmoor, Aug 1993, *Fensham 971* (AD, BISH, BRI, CANB, DNA, K, L, MEL, NSW); Exmoor, Jun 1996, *Forster PIF19192* & *Tucker* (BRI). Blackwall Ranges, Exmoor, Sep 2003, *Dennis 104* (BRI); Exmoor, S of Collinsville, Mar 2017, *Fensham 6592* (BRI); *ibid*, Mar 2017, *Fensham 6606* (BRI). Cultivated. MORETON DISTRICT: Cooroy ex 'Exmoor', Dec 2014, *Tucker s.n.* (BRI [AQ0839498]).

Distribution and habitat: *Brachychiton guymeri* is known from two locations about 10 km apart, approximately 60 km southeast of Collinsville in the South Kennedy district.

The main known population (Blackwall Range) of *B. guymeri* occurs in fragmented dry rainforest (semi-evergreen vine-thicket) on a granodiorite boulder field with little to no surface soil. It also extends into the adjoining grassy woodland habitat that is less rocky. The second population (Aureole) occurs on a mixture of granodiorite and sandstone that is also grassy. Both sites receive about 680 mm mean annual rainfall.

Brachychiton guymeri occurs as a locally common tree with other species of dry rainforest including *B. australis* (Schott & Endl.) A.Terracc. Unlike *B. australis* the

species also occurs in adjacent eucalypt woodland. Other co-occurring dry rainforest species include *Abutilon auritum* (Wall. ex Link) Sweet, *A. micropetalum* Benth., *Alyxia ruscifolia* R.Br., *Lysiphyllum hookeri* (F.Muell.) Pedley, *Gyrocarpus americanus* Jacq., and *Terminalia aridicola* Domin. The woodland includes *Eucalyptus crebra* F.Muell., *Corymbia erythropholia* (Blakely) K.D.Hill & L.A.S.Johnson, *Eucalyptus melanophloia* F.Muell. and a mixture of grasses including introduced buffel grass (*Cenchrus ciliaris* L.).

Phenology: Flowering period June to December (?); Fruiting December to March. Deciduous during dry season (~August to December).

Notes: We posit that *Brachychiton guymeri* is morphologically most similar to *B. bidwillii* as diagnosed above. The species can also be clearly separated from *B. vitifolius* by raised adaxial veins (versus distinctly impressed), significantly smaller leaves 2.2–8.4 cm long, 0.8–6 cm wide (versus 12–19 cm long, 14–21 cm wide), singular flowers (versus 8–20 flowers per inflorescence), perianth interior stellate-hirsute (versus sparsely glandular-puberulent) and larger follicles 6–9 cm long, 2–4 cm wide (versus 3–6 cm long, 2–3 cm wide).

In the limited molecular analyses for this species presented by Carter (2011), *Brachychiton guymeri* showed no difference from *B. bidwillii* based on chloroplast data from four regions. Unfortunately Carter (2011) was unsuccessful in sequencing the nuclear *G3pdh* region for the species. While molecular support for *B. guymeri* remains equivocal at this point, the morphological differences are distinct. Our speciation hypothesis is that *B. guymeri* represents an allopatric speciation event with *B. bidwillii* as the sister species or as part of an ancestral lineage.

Three main scenarios can be applied to this speciation hypothesis for *Brachychiton guymeri*. These scenarios are strongly influenced by the extant occurrence of both species and how they relate to proposed

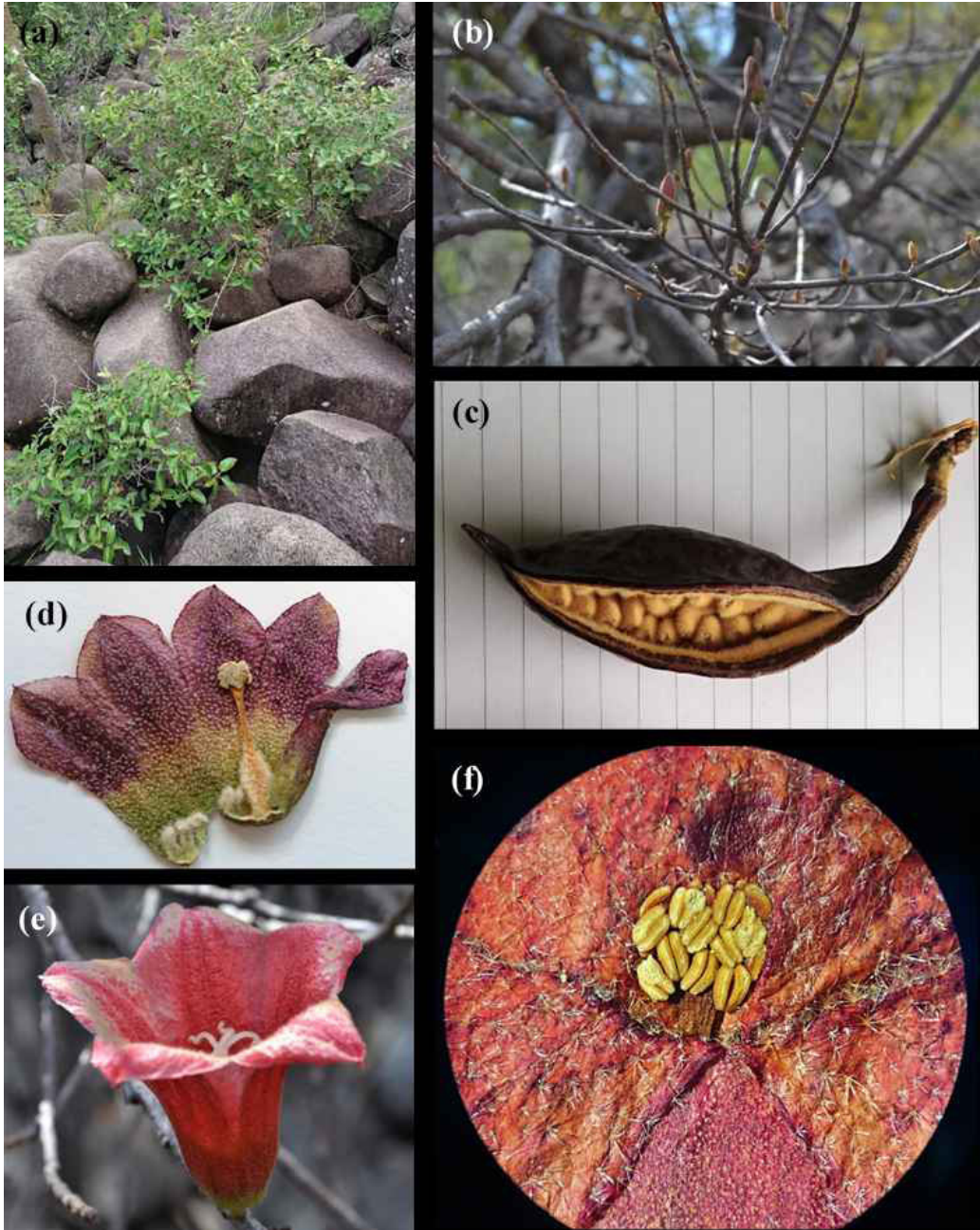


Fig. 2. *Brachychiton guymeri*. A. species habit. B. inflorescence composed of single axillary flower. C. woody dehiscent cymbiform follicle with intact exotesta. D. male flower. E. female flower. F. variations in indumentum on interior and exterior (bottom centre) of perianth. All from the Blackwall Range population (Fensham 6592, BRI)

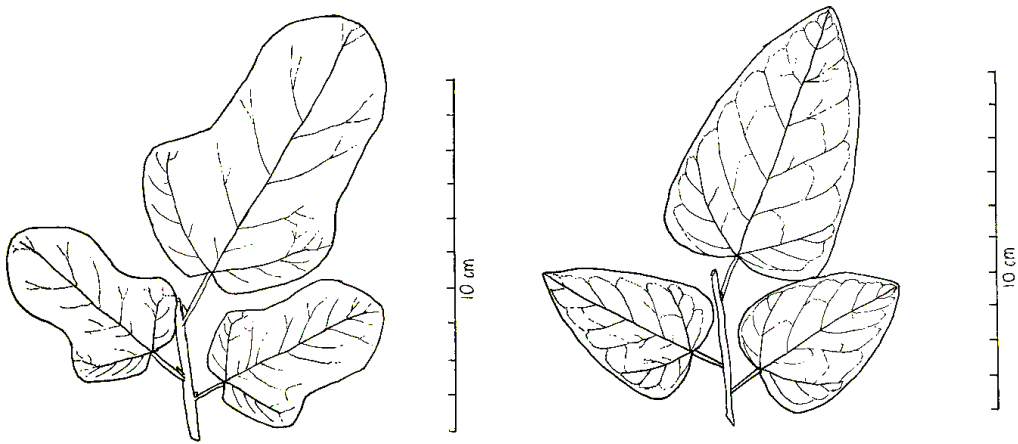


Fig. 3. Leaf shapes of *Brachychiton guymeri*. The most typical form is on the left. The top leaf represents the maximum leaf length with appropriate dimensions; the left leaf is the mean dimensions; and the right leaf is the median dimensions. All from the Blackwall Range population (Fensham 6606, BRI).

biogeographic gaps in eastern Queensland (Bryant & Krosch 2016). While *B. guymeri* has a very small and defined extant area of occurrence, the situation with *B. bidwillii* is more complex. *Brachychiton bidwillii* occurs in two population centres, a northern population centre that is very small and restricted entirely to Magnetic Island offshore from Townsville (north of the Burdekin Gap), and a southern population centre comprising numerous subpopulations south of the St Lawrence Gap from Shoalwater Bay south to Boonah. In terms of the Bryant & Krosch (2016) biogeographic barriers, *B. guymeri* is quite unusual as it is in the area south of the Burdekin Gap and north of the St Lawrence Gap, well separated from *B. bidwillii* by over 200 km to the north and over 250 km to the south.

(Scenario 1) Model I of Levin (2000), *viz.* vicariant speciation, requiring local adaption to the unique habitat formed by the granodiorite outcrop. This scenario would require populations of *B. bidwillii* to be not markedly disjunct.

(Scenario 2) Model II of Levin (2000), *viz.* peripatic speciation, would require

locally dispersed populations diverging from relatively nearby populations of *B. bidwillii*.

(Scenario 3) Model III of Levin (2000), *viz.* disjunct speciation, divergence following long range dispersal or from remnant populations of a once more widely distributed *B. bidwillii* that has now retreated beyond the above biogeographic barriers.

Given the considerable distance between populations of *B. guymeri* and *B. bidwillii*, the third scenario of disjunct speciation is putatively the most likely.

The observed rarity of *Brachychiton guymeri*, yet abundance of potentially suitable habitat (see discussion below), indicates a number of possibilities for this species in terms of its existence in space and time (Levin 2000). Either this is a species near to the start of its existence that has only recently managed to disperse to a second population, or a species near the end that is now restricted to refugia. The broad availability of habitat in the local area tends to favour the first possibility.



Fig. 4. *Brachychiton guymeri* germination and development of lignotuber. Germinating seed without release of cotyledons (left); lignotuber formed prior to leaf development (centre); stem and leaves emanating from lignotuber (right).

Conservation status: *Brachychiton guymeri* (as *B. sp.* (Blackwall Range R.J. Fensham 971) is currently listed as **Endangered** under the Queensland *Nature Conservation Act 1992*, but we recommend amending the status to **Vulnerable** (see below).

Survey for extent of occurrence

Within the surveyed area of approximately 548,000 ha, 3111 ha or 0.57% was mapped as dry rainforest (**Fig. 5A**; **Table 2**). The dry rainforest consisted of 764 patches, 82.2% of which were smaller than 5 ha, although 58.8% of the total area of dry rainforest was made up of patches larger than 5 ha (**Table 2**).

Fifty-three dry rainforest patches were surveyed for the presence of *Brachychiton guymeri* but no additional populations were located (**Fig. 5B**). The total area searched was 770 ha or 24.7% of the total mapped area of dry rainforest in the survey area (**Table 2**). The majority of patches surveyed in the current research were less than 10 km away from either one of the known populations (**Fig. 5B**).

Population survey

The total habitat area was 34.3 ha, with 10.6 ha of dry rainforest habitat at the Blackwall Range site, 21.8 ha in the surrounding grass dominated area, and the remaining 1.9 ha

at the Aureole site (**Fig. 6**). The extent of occurrence was 23 km² and the area of occupancy based on habitat maps (**Fig. 6**) was 39 ha, therefore 4 km² grid cells or a total of 1200 ha using IUCN guidelines (IUCN Standards and Petitions Subcommittee 2017).

The total population of the target species was estimated to be 11000±1900. Of this, 56% were located in the dry rainforest habitat at the original site. The savanna of the primary site contained 11%, while the Aureole savanna population comprised the remaining 33%.

The population size structure was fairly evenly distributed in the dry rainforest at Blackwall Range (**Fig. 7**), and the low density of large trees (> 5 cm dbh) is indicative of the generally shrub-sized stature of *B. guymeri*. In the savanna surrounding the dry rainforest, no individuals under 50 cm were recorded, and other sized classes were at much lower densities than within the dry rainforest. The Aureole savanna population had very high densities of individual less than 2 m high, and low densities of larger individuals (**Fig. 7**).

Discussion

The analysis of the stand structure for *Brachychiton guymeri* revealed a relatively high density of smaller individuals within the dry rainforest population at Blackwall Range. This suggests a stable, self-sustaining

population. The presence of medium-sized individuals indicates that *B. guymeri* can establish in relatively fire-prone savanna environments while the absence of small sized-class individuals indicates there has been no recent recruitment or perhaps indicates a long absence of fire, such that young shoots regenerating from coppice after ‘top-kill’ by fire are absent. The long-term absence of fire at this site is consistent with the recollections of the landholders who have no memory of fire in this area for at least 20 years (E. Comerford pers. comm.).

The Aureole population by contrast has very few mature trees, but a prolific number of smaller individuals. This pulse of vegetative regeneration is likely a result of a basal resprouting after a fire that occurred in 2015. *Brachychiton guymeri* can occupy both fire-protected dry rainforest and fire-prone savanna. *B. guymeri* can regenerate from lignotubers after fire and is much more fire tolerant than its congener *B. australis* that is extremely fire sensitive (Fensham *et al.* 2003).

Brachychiton guymeri appears to have a very limited geographic distribution with two known populations *c.* 10 km apart. While only a small proportion of the dry rainforest within the region where *B. guymeri* occurs has been surveyed (Fig. 5; Table 2), it was found to be absent from 51 nearby patches. Dry rainforest generally exhibits a high

degree of floristic homogeneity, with 87% of species found in inland dry rainforest also occurring within 1 km of the coast (Fensham 1995). These communities are predominantly made up of generalists with broad geographic ranges and species with restricted distributions are unusual amongst the dry rainforest flora. This homogeneity of the flora is consistent with species that are readily dispersed, predominantly by birds and bats (Russell-Smith & Lee 1992). The co-occurring congener *Brachychiton australis* is a widespread tree so the rarity of *B. guymeri* is puzzling as it is clearly more fire tolerant than *B. australis*.

Threat status

The criteria for assessing the conservation status of species is strongly dependant on assessing or predicting a decline in population such that it is at risk of extinction, and the influence of threatening processes that may cause such a decline (IUCN 2001).

There are no immediate threats to *Brachychiton guymeri*. By virtue of its location on rocky slopes, it faces little threat of disturbance by domestic and feral species, and the habitat is not suitable for clearing for agricultural purposes (Fensham 1996). The encroachment of introduced grass species into the margins of dry rainforest habitat at these sites is limited by the lack of exposed soil.

Table 2. Summary data on dry rainforest within 50 km of the known populations of *Brachychiton guymeri* in areas with less than 900 mm mean annual rainfall

	Number of patches	Area	Proportion of total study area	Proportion of total dry rainforest area
Total dry rainforest area	764	3111 ha	0.57 %	-
patches > 5 ha	136	2140 ha	0.39 %	68.8%
Surveyed	53	770 ha	0.14 %	24.8 %

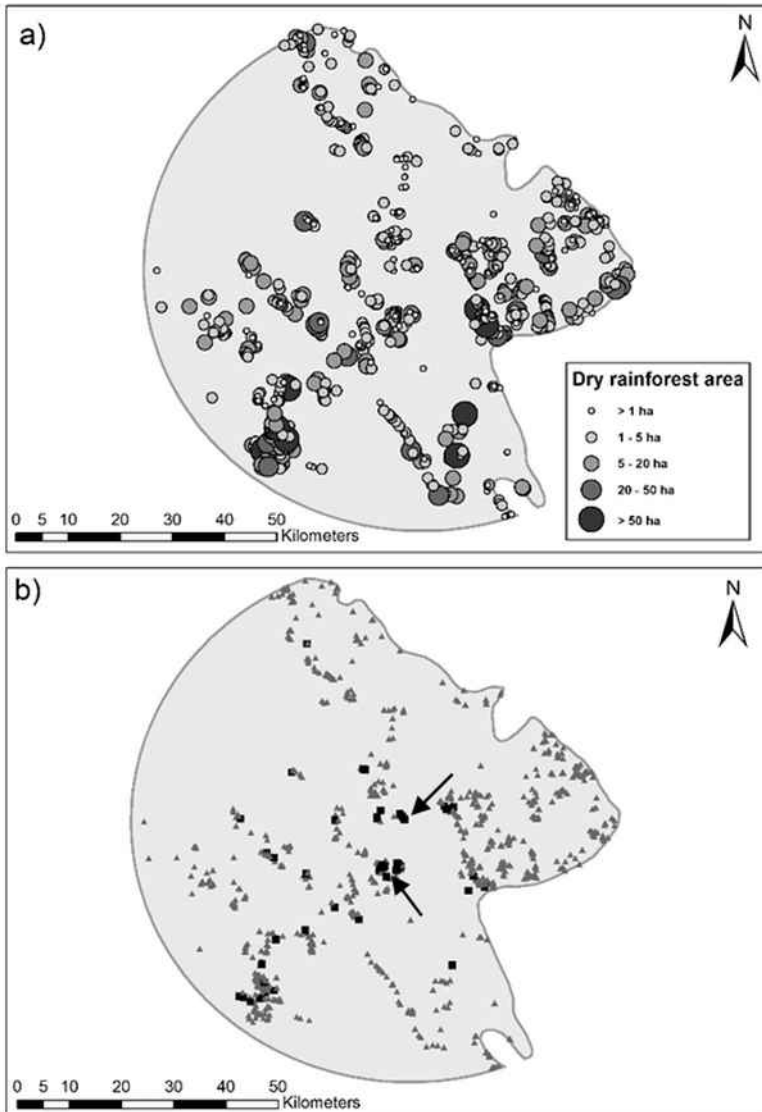


Fig. 5. The location of dry rainforest patches within 50 km of the largest population in areas with less than 900 mm rainfall, a) according to their area; b) with surveyed sites (black squares) and unsurveyed sites (grey triangles). The location of the Blackwall Range population (north arrow) and Aureole population (south arrow) is indicated on b).

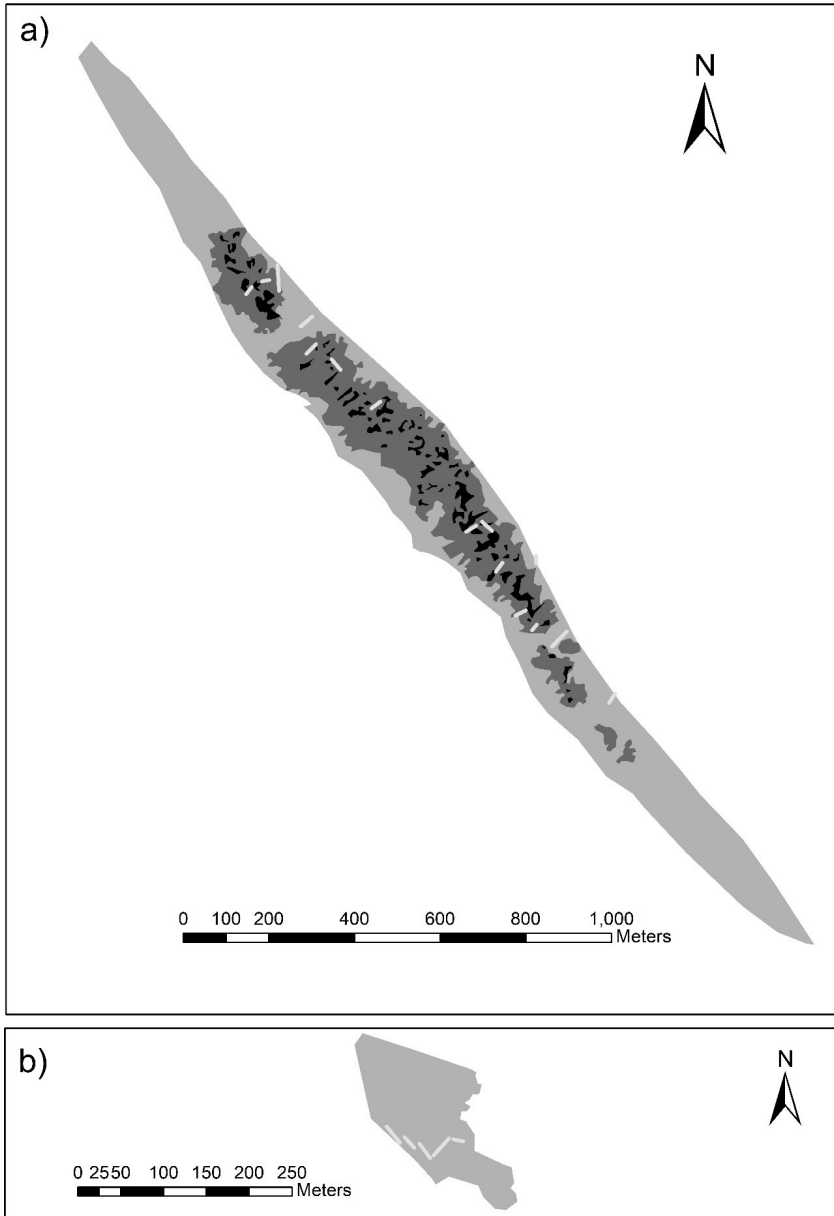


Fig. 6. Maps of population extent at the a) Blackwall Range population; and b) the Aureole population. Skeletal boulderfield devoid of vegetation (black), dry rainforest (dark grey), grassy vegetation (light grey). The position and length of the surveyed transects are shown as white lines

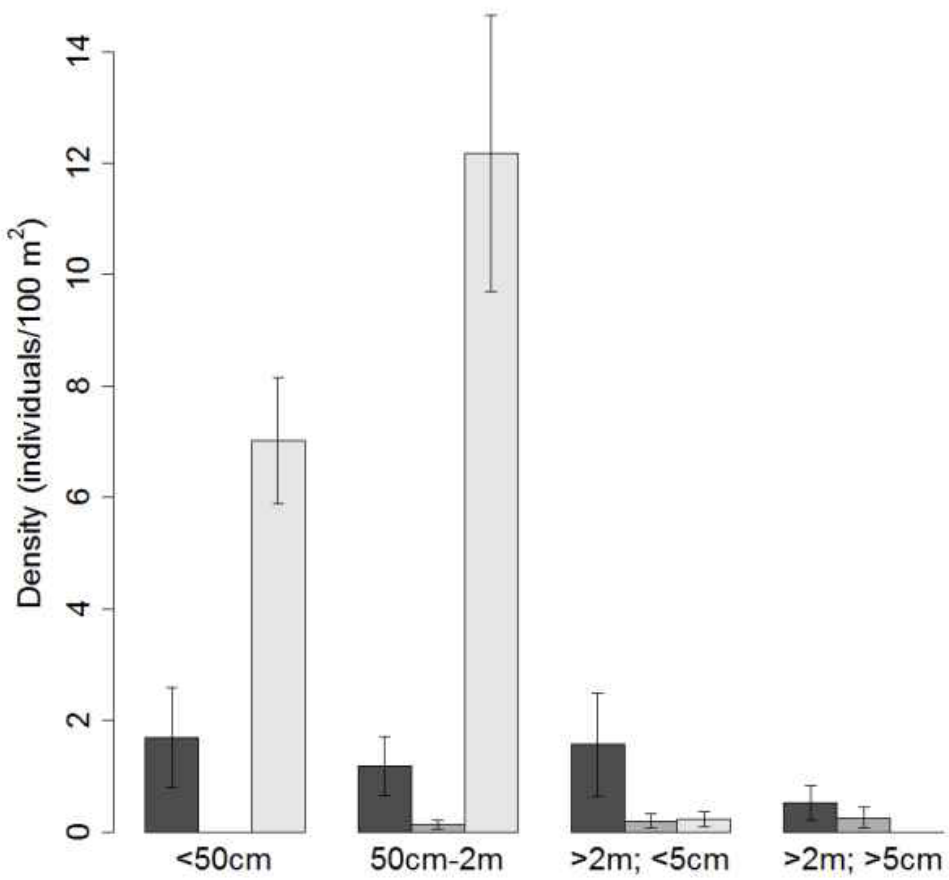


Fig. 7. Mean density (with standard error bars) of each size category of *Brachychiton guyeri* in dry rainforest (dark grey) and savanna (medium grey) at the Blackwall Range and Aureole (light grey) sites.

According to the most recent IUCN guidelines (IUCN Standards and Petitions Subcommittee 2017) ‘It must be emphasized that the restricted area of occupancy under criterion D2 is defined such that the population is prone to the effects of human activities or stochastic events in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period (e.g., within one or two generations after the threatening event occurs).’ It is conceivable that either of the populations could be subject to extirpation by a development project such as a mine. Gold deposits are associated with the granodiorite (Hecate Granite on 1:250 000 Geological Series Map) and the sediments include coal deposits (Paine & Cameron 1972).

The species’ known habitat is regulated vegetation and protected from clearing under the Queensland *Vegetation Management Act 1999* and its essential habitat provisions (https://researchdata.and.s.org.au/vegetation-management-essential-version-418/562955?source=suggested_datasets). In addition, known individual plants are protected under Queensland’s Protected Flora Survey Trigger map (<https://environment.des.qld.gov.au/licences-permits/plants-animals/protected-plants/map-request.php>).

On the basis of such a threat in the future we recommend a revised listing of *Brachychiton guyeri* as **Vulnerable** under Criterion D: ‘Population with a very restricted area of occupancy (typically less than 20 km²) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.’

Etymology: Named for Dr Gordon Paul Guymer, author of the seminal work on the genus and Director of the Queensland Herbarium since 1991.

Acknowledgements

We thank Boris Laffineur for his assistance in spatial matters and logistics, Esther Haskell, Patrick Fahey, Gabrielle Lebbink and Gary Reed for their feedback and field assistance, Rosie Matters and Gordon Guymer for assistance and advice with regards to growing the focus species, and the Comerford family for generously hosting us during field work.

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