

Eucalyptus morrisbyi

morrisbys gum

TASMANIAN THREATENED SPECIES LISTING STATEMENT



Image by Naomi Lawrence

Scientific name: *Eucalyptus morrisbyi* Brett, *Pap. & Proc. Roy. Soc. Tasmania* 129: pl. 14–15 (1939)

Common name: morrisbys gum

Group: vascular plant, dicotyledon, family **Myrtaceae**

Status: *Threatened Species Protection Act 1995:* **endangered**
Environment Protection and Biodiversity Conservation Act 1999: **Endangered**

Distribution Biogeographic origin: **endemic to Tasmania**
Tasmanian Natural Resource Management Region: **South**
Tasmanian IBRA bioregions (V6): **South East**

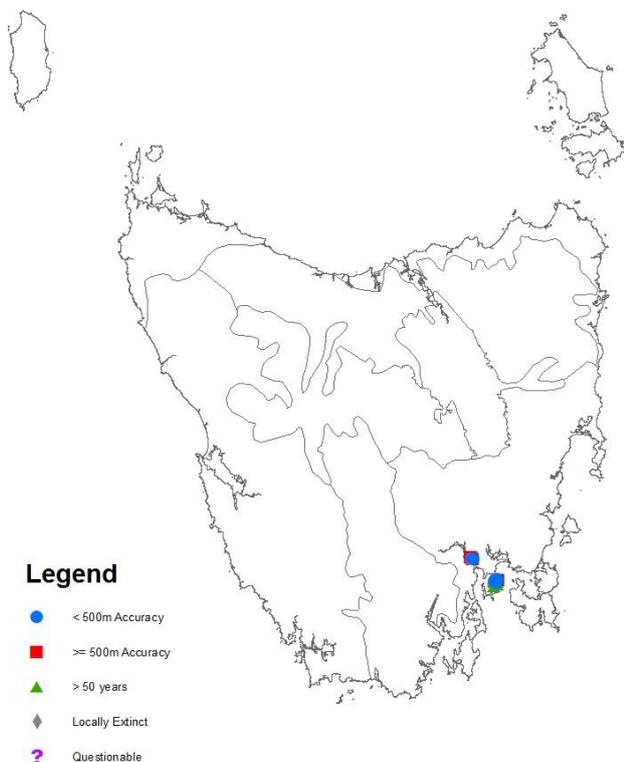


Figure 1. Distribution of *Eucalyptus morrisbyi*, showing IBRA bioregions



Plate 1. *Eucalyptus morrisbyi*: buds, capsules, adult & juvenile leaves (scale bar=2cm) (images by Brad Potts)

SUMMARY: *Eucalyptus morrisbyi* (morrisbys gum) is a small tree endemic to Tasmania's southeast. It is only known from two locations 21 km apart; in the Government Hills near Risdon, and the fragmented Cremorne subpopulation which now consists of a main stand at Calverts Hill and several small remnant stands following past clearing for residential and agricultural purposes. The Risdon and the main Calverts Hill stands have suffered rapid dramatic declines in recent decades with the loss of all but a few mature trees which are all located at Calverts Hill. The Risdon stand is now considered to be functionally extinct as it no longer produces seed. This leaves the species with fewer than 30 mature trees in the wild that produce seed. The species appears to have been contracting to wetter gullies over time, exacerbated by the recent warmer and drier conditions associated with climate change. The species is highly palatable and once stressed, recovery is hampered by vertebrate and insect browsing that if left unchecked leads to the death of trees within years. The smaller roadside stands in the Cremorne area are additionally at risk from clearing to improve road safety and the small Lumeah Point stand cannot expand due to existing urban development. While at imminent risk of extinction in the wild, the species is not likely to face extinction in the short to medium term due to ornamental and ex situ plantings. The most immediate needs are to protect wild and planted seedlings at Calverts Hill to allow them to reach maturity and to ensure that the genetic variability of the species is maintained by supplementing and managing seed collections that can be used for future conservation actions.

IDENTIFICATION AND ECOLOGY

Eucalyptus morrisbyi is a small tree, growing to a height of approximately 6 to 12 m. Seedlings take about ten years to produce flowers, a relatively long time for eucalypts. Peak flowering occurs from February to May (Williams and Potts 1996). The species is relatively well adapted to fire, which stimulates release of seed from capsules for regeneration.

If flowering is compromised, the canopy held seedbank is only viable for about two years as capsules become too woody to release their seed. The Calverts Hill stand in particular has a large number of seedlings that have been repressed by continuous browsing to ground level and potentially may be many years old. Plants in the Risdon stand have resprouted from lignotubers following a major dieback event and genetic testing of stems has demonstrated considerable clonality in the stand (Jones et al. 2005).

Eucalyptus morrisbyi is susceptible to drought, being the first of the local eucalypts to show signs of stress following drought events, with stress symptoms particularly evident in trees growing on drier sites. Stressed plants including any regrowth are more susceptible to vertebrate and insect browsing, often rapidly resulting in death or dieback.

There are considerable genetic differences between the Calverts Hill and Risdon stands. Plants from the Risdon stand are less palatable to vertebrate browsing as demonstrated in mixed plantings (Mann et al. 2012). However, plants from the Risdon stand have been shown to be more susceptible to myrtle rust (*Austropuccinia psidii*) (newly introduced to Tasmania) than those from Calverts Hill (Potts et al. 2016).

Plants from the two stands can be distinguished using molecular techniques (Jones et al. 2005). Some molecular differences are also evident between plants from the Calverts Hill stand and its associated remnant stands in the Cremorne area.

Despite the small size of the Risdon subpopulation, variation remains high and it is not showing signs of inbreeding. This may be a consequence of inbreeding being limited by the high levels of self-incompatibility shown by the species (Potts & Savva 1988) and the longevity of the existing genotypes.

Although *Eucalyptus morrisbyi* hybridises with *Eucalyptus viminalis* in the wild, studies have not revealed significant contamination of its gene pool.

Description

While *Eucalyptus morrisbyi* is generally rough barked at the base of the trunk, the old bark is shed further up leaving the upper part of the trunk and the branches smooth and brown, white-grey or pink-grey in colour. The bluish-green juvenile leaves are glaucous, unstalked and rounded, 2 to 3 cm long and 2 to 4 cm wide. They are arranged in opposite pairs. The adult leaves are stalked, less glaucous and arranged alternately. They are about 5 to 10 cm long and 1.5 to 4 cm wide. The flower buds have a pointed cap and are glaucous and shortly stalked. They arise in clusters of three from the leaf axils. The flowers are cream and develop into cylindrical, glaucous, woody capsules, 9 to 11 mm long and 6 mm wide (Plate 1).

[description based on Curtis & Morris 1975]

Survey techniques

This small tree can be identified at any time of the year, though mature trees (with capsules) are required to confirm the identity of this species.

Confusing Species

Eucalyptus morrisbyi can be confused with the closely related *Eucalyptus gunnii* (cider gum), and *Eucalyptus cordata* (heart leaved silver gum). It can be distinguished from *Eucalyptus gunnii* by its coastal lowland habitat and presence of warty protuberances on buds and capsules. It can be distinguished from *Eucalyptus cordata* by its smaller capsules that occur in the axils of adult leaves only. Refer also to Wiltshire and Potts (2007). *Eucalyptus morrisbyi* can hybridise with *Eucalyptus viminalis* and some stands and older plantings contain a significant proportion of hybrid trees. The hybrids are readily distinguished by their narrower and less glaucous juvenile leaves.

DISTRIBUTION AND HABITAT

Eucalyptus morrisbyi is endemic to Tasmania with wild occurrences known only from the Cremorne area, with a main stand at Calverts Hill and several small nearby remnant stands, as well as from a small subpopulation 21 km away in the Government Hills near Risdon (Figure 1, Table 1).

A number of conservation plantings have been made and *Eucalyptus morrisbyi* has been widely planted as a specimen tree and ornamental.

In natural stands, *Eucalyptus morrisbyi* occurs in coastal, dry sclerophyll woodland on gentle to hilly slopes where it tends to be restricted to gullies that offer some relief in this drought prone, low rainfall area. It is associated with poor soils, with the Calverts Hill and associated remnant stands occurring on recent sands overlying dolerite and the Risdon stand on Permian mudstone. The species tends to occur in relatively pure stands with a number of other eucalypt species occurring nearby.

RESERVATION STATUS

Eucalyptus morrisbyi is formally protected in the Calverts Hill Nature Reserve and the East Risdon State Reserve. The Lumeah Point stand is on a coastal reserve that has been leased to the Clarence City Council for recreational use.

POPULATION PARAMETERS

Number of subpopulations: 2 (1 reproductive)

Number of locations: 2 (1 reproductive)

Extent of occurrence: ~45 km²

Area of occupancy: ~ 12.5 ha
(0.5 ha for mature individuals)

Area of occupancy (as per IUCN criteria): 8 km²
(or 4 km² as reproductive in only 1 location)

No. of mature individuals: < 30

Eucalyptus morrisbyi is known only from two subpopulations in the wild (Table 1). In the Cremorne area, the subpopulation has been fragmented into the Calverts Hill stand, and several small remnant stands approximately 2 km away. The species is no longer present at some sites where it was collected in the past in the Cremorne area. Numbers in the smaller remnant stands have been supplemented by plantings and other plantings in the area have been made.

A census of trees in the Risdon subpopulation in 1996 showed 69 trees with adult foliage, though less than 20 of these were carrying seed. This stand is now functionally extinct with only weak, spindly, non-reproductive lignotuber regrowth remaining.

The Calverts Hill stand is close to being functionally extinct. There were 1915 mature trees in the Calverts Hill stand in 1991 and only seven mature trees were still alive in early 2018 (one dying) following a dramatic decline that started after 2005 (and was first reported in 2014 at which time 70 to 80% of mature trees had already died). Seed-bearing mature individuals can still be found in the small remnant patches in the Cremorne area though some of the roadside trees have died since the last census in 1991. In total, the number of naturally occurring mature trees (reproductive) of *Eucalyptus morrisbyi* is estimated to be fewer than 30.

At least two mid-1990s ex situ plantings grown from a genetically diverse collection of seed from Calverts Hill are reproductive, with recruitment present in the understorey. Once the seedlings grow to maturity, these plantings could be considered to be self-perpetuating and could be included as subpopulations for the purposes of applying extinction risk criteria.

Conservation Assessment

Eucalyptus morrisbyi meets the following criteria for listing as endangered on the Tasmanian *Threatened Species Protection Act 1995*:

- A. Total population reduction in the form of
 1. an observed reduction of at least 50% within the last three generations (to a maximum of 100 years) based on
 - a. direct observation
- B. Extent of occurrence estimated to be less than 5,000 km², and
 1. it is known to exist at no more than five locations, and
 2. there is a continuing decline observed in the number of mature individuals
- C. Total population estimated to number fewer than 2,500 mature individuals, and
 - 2 there is a continuing decline observed in numbers of mature individuals and
 - a.(i) no subpopulation estimated to contain more than 250 mature individuals,
 - a.(ii) at least 90% of all mature individuals in a single subpopulation
- D. Total population estimated to number fewer than 250 mature individuals.

It qualifies as Critically Endangered using the IUCN (World Conservation Union) Red List criteria given its restricted distribution, a greater than 80% decline observed in the number of mature individuals and fewer than 50 mature individuals remaining in the wild.

Eucalyptus morrisbyi forest and woodland is listed as a threatened vegetation community on schedules of the *Nature Conservation Act 2002*.

THREATS, LIMITING FACTORS AND MANAGEMENT ISSUES

Eucalyptus morrisbyi has undergone a dramatic decline in recent decades to the point at which the species is at imminent risk of becoming extinct in the wild. Extinction of the species as a whole is unlikely, at least in the short to medium term, given the presence of ex situ and ornamental plantings. The main issues with the decline and recovery prospects are discussed below.



Plate 2. Calverts Hill site, April 2016
(image by Richard Schahinger)

Clearing and fragmentation: Past records indicate a decline from clearing for agriculture and urban development of at least 50% in the area occupied by *Eucalyptus morrisbyi* in the Cremorne area since European settlement (Wiltshire 1992). Much of the original Lumeah Point stand is likely to have been cleared, with the remaining trees in a narrow coastal strip adjacent to a housing subdivision. The risk of further clearing has decreased with the reservation of the bulk of the Calverts Hill stand in 2007.

Table 1. Population summary for *Eucalyptus morrisbyi*

	Subpopulation	Tenure	NRM region	1:25,000 mapsheet	Year of census	Area of occupancy (ha)	Number of adult trees (NR not reproductive)
1.1	Calverts Hill	Calverts Hill Nature Reserve	South	Cremorne	2019 2018 1991	11.5	6 7 1915
1.2	Lumeah Point	Coastal Reserve	South	Cremorne	2019 1991	0.15	^ 16
1.3	Honeywood Drive	road reserve*, private land	South	Cremorne	2019 1991	0.15	>8^^ 12
1.4	South Arm Road/ Delphis Drive				2017		6^^^
1.5	Cremorne Avenue				2019 1991		5^^^^ ~5
2	Government Hills, East Risdon	East Risdon State Reserve	South	Hobart	2014 2002 1996	0.7	0 (219 ^{NR})** 0 (81 ^{NR}) <20 (69 ^{NR})

*managed by the Department of State Growth for sites 1.4 and Clarence City Council for sites 1.3 and 1.5

**of the 219 stems sampled, there were 110 distinct genotypes (Jones unpubl.)

^mix of natural and planted trees both pure and hybrid, more hybrids than pure, some recruits

^^seed collected from 8 trees, others with little seed, no recruits

^^^plus 9 planted (North Barker Ecosystem Services 2017)

^^^^plus 2 hybrids and some planted (origin disputed)

However, the roadside remnant stands have suffered from roadside maintenance and are at risk of being cleared for safety reasons as they impede line of sight to the highway from access roads to new subdivisions.

The stands in the Cremorne area have also suffered from woodcutting. The fragmentation caused by conversion for agriculture, roads and housing has contributed to invasion by weeds and increased vertebrate and insect browsing pressure in the stands.

Climate change: *Eucalyptus morrisbyi* is susceptible to drought, with the range of the species apparently retracting to wetter gullies since the last glaciation (Wiltshire et al. 1991). This makes the species particularly vulnerable to the warmer conditions and changed rainfall patterns associated with the accelerated rate of climate change seen in recent decades. As well as increasing transpiration rates, warmer and drier conditions may cause an increase in the browsing pressure on *Eucalyptus morrisbyi* as food resources become restricted or as a result of local increases in insect populations.

It is now evident that with the current rate of climate change, significant intervention will be required to maintain *Eucalyptus morrisbyi* in the wild.

Vertebrate browsing: Genotypes from the Calverts Hill stand are particularly palatable to vertebrate browsing (mainly possums, wallabies and possibly rabbits). While there are a large number of seedlings still evident in the Calverts Hill stand following the death of all but a few mature trees, they were continually being browsed, often to ground level after resprouting from lignotubers.

Several areas with seedlings (natural or planted) have been fenced or caged, allowing the seedlings to grow, but possum damage was evident where fences had been breached or seedlings had outgrown their cages. Further works to prevent browsing by possums and other vertebrates include the installation of perimeter and some internal fencing, cutting of overhanging branches, and relocation of possums.

However, relocation of browsers and maintenance of fences for at least the next 7 to 10 years may be required to allow the seedlings in this stand to grow to maturity and regular surveillance will be required to allow prompt intervention before significant damage occurs. Surrounding agricultural land is likely to continue to attract vertebrate browsers to the site.

Insect browsing: Both subpopulations of *Eucalyptus morrisbyi* are highly susceptible to insect browsing. The mortality rate, particularly of saplings and seedlings, is high following drought stress and the trees appear to become more susceptible to defoliation caused mainly by the autumn gum moth (*Mnesampela privata*).

The mortality rate, particularly of saplings and seedlings, has also been observed to increase following high rainfall growing seasons due to outbreaks of insect populations. Surviving trees are weakened and flowering is compromised in following seasons. Warmer temperatures and unusually wet periods in warmer months may encourage increased insect populations.

Allowing seedlings to reach maturity will require monthly monitoring in spring, summer and into autumn, and treatment of insect outbreaks. Weeds may also attract and contribute to insect outbreaks.

Noisy miners (*Manorina melanocephala*) are native honey eaters that can move into eucalypt stands in large numbers, particularly when the stands are fragmented and drought stressed, where they drive out other bird species by their aggressive behaviour. By driving out insect eating birds, noisy miners can cause increases in insect populations that can result in eucalypt dieback (Bennett et al. 2015).

While noisy miners have been noted in the Calverts Hill stand, it is not known whether they contributed to the recent decline and monitoring will be required to determine whether they might adversely impact recovery. ‘Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant noisy miners (*Manorina melanocephala*)’ is listed as a threatening process under the *Environment Protection and Biodiversity Conservation Act 1999*.

Competition: The poor health of the Risdon subpopulation has reduced its competitive ability. In the late 1970s, a native parasitic vine, *Cassytha pubescens*, threatened to smother and kill many of the trees and was removed (Brown & Bayley-Stark 1979). The understorey of silver wattle, blackwood and prickly mimosa was thinned in October 2001 in order to further reduce competition stress on the trees. These actions have not reversed the decline.

Weeds: Drought conditions and a lack of awareness in relation to identification and impacts, have allowed serrated tussock (*Nassella trichotoma*), a declared weed and Weed of National Significance to significantly increase in numbers. It is present in the Calverts Hill stand, where it poses a significant threat if not controlled, by invading recruitment niches and increasing fire frequencies by significantly increasing the fuel load. Control will need to be ongoing given continual invasion from large occurrences that may not be possible to eradicate on adjacent cleared land within and surrounding the Calverts Hill Nature Reserve.

Invasion of recruitment niches by chilean needlegrass (*Nassella neesiana*), another declared weed, is a risk to the smaller remnant stands of the Cremorne subpopulation.

The diversity of weeds in the Cremorne subpopulation may increase insect damage to *Eucalyptus morrisbyi* by supporting increases in insect populations.

Fire: Frequent fires will cause a decline in stands. While larger trees can resprout from lignotubers and epicormic buds, smaller trees will be killed. If the store of seed held in the canopy is not replenished in the fire-free interval, recruitment from seedlings will not replace the individuals killed.

The small Risdon subpopulation is particularly at risk from fire as the mortality rate would be high given the poor health of trees and currently there is no seed being produced in the stand. A burn in the area, however, may provide an opportunity to replant the fire created recruitment niches using stored seed.

Fire will need to be excluded from the Calverts Hill stand until most of the wild and planted seedlings are large enough to survive a burn.

Stock grazing of cleared land at Calverts Hill to reduce fuel loads and the establishment of a mineral earth fire break have been undertaken to protect recovering seedlings from wildfires.

Ex situ management of genetic resources: Ex situ plantings were established at Brighton in 1994, and Geeveston and Lutana in 1999. These seed orchards provide a resource of seed for revegetation and long-term storage. An additional planting at Meadowbank was burnt in 2012 and the trees are not currently reproductive.

The Brighton planting was established from seed from plants originating from the Calverts Hill stand and genetically diverse seed has been collected from this planting.

The health and seed output of the declining Risdon subpopulation was briefly improved following an unusually wet spring and summer in 1995/96, allowing seed to be collected for the establishment of the Geeveston and Lutana ex situ plantings. Seed from the Geeveston site has subsequently been collected for conservation storage.

The Geeveston ex situ planting was planted with alternate rows of seedlings from the Risdon and Calverts Hill stands. The Calverts Hill derived plants were severely browsed with only one tree flowering at the time the seed was set so that there would have been minimal contamination of the Risdon Hills seed collected. If necessary, molecular techniques could be used to identify and cull any intraspecific hybrids though molecular studies indicate that the contamination was minimal and restricted to seed from trees surrounding the flowering tree from Calverts Hill (Jones unpubl.). Supplementation of the collection may require prior pruning of any of the Calverts Hill trees with flower buds.

Given genetic differences, the supplementation of the small collection of seed from the smaller remnant stands in the Cremorne area is warranted. The *Eucalyptus morrisbyi* seed collections are currently held in long term conservation storage at the Tasmanian Seed Conservation Centre based at the Royal Tasmanian Botanical Gardens.

Seed used in most of the ornamental and early conservation plantings is thought to have originated from the smaller fragments of the Cremorne subpopulation.

However, the seed used was collected from a small number of individuals that may not have been representative of the genetic variation available and it included hybrids that were not culled prior to planting. A relatively large number of trees planted at Lumeah Point in order to supplement numbers in the stand appear to be hybrids.

Maintenance of the species in the wild: Given the decline of the Risdon and Calverts Hill stands and small size and threats faced by the four smaller remnant stands of the Cremorne subpopulation, maintenance of the species in the wild will be dependent on recovery of the Calverts Hill stand.

Recovery of the Risdon stand is unlikely to be feasible given the small area occupied by the species and ongoing decline that has not been possible to arrest. A burn in the area, however, may alleviate threats and provide an opportunity to replant the fire created recruitment niches using stored seed.

Recovery of the Calverts Hill stand will be dependent on ongoing control of vertebrate and insect browsing pressure to allow existing seedlings and supplementary plantings to survive to maturity. However, to improve the prospects of maintaining the species in the wild, plantings of the more vertebrate browsing resistant Risdon genotypes have been made at the site. To alleviate edge effects, a buffer planting of more drought tolerant eucalypt species could be considered.

MANAGEMENT STRATEGY

The main objectives for the recovery of *Eucalyptus morrisbyi* are to maintain the species in the wild by arresting declines and to preserve genotypic variation within the species through conservation storage of seed and the establishment of ex situ plantings in areas where the future climate is expected to be suitable for the species.

What has been done?

- Long-term research conducted at the University of Tasmania has been fundamental to our understanding of the population genetics, evolutionary relationships, and population decline.
- Implementation of a Recovery Plan for *Eucalyptus morrisbyi* commenced in 1992. The Recovery Plan was revised in 2006 (Threatened Species Section 2006). Both plans were partially implemented.
- The bulk of the Calverts Hill stand of *Eucalyptus morrisbyi* is now in the Calverts Hill Nature Reserve, acquired through the 1999 Regional Forest Agreement (RFA) Private Forest Reserve Program.
- Ex situ plantings and seed orchards are being maintained by Forestry Tasmania and the University of Tasmania, School of Biological Science.
- Serrated tussock in the Calverts Hill Nature Reserve is being managed.
- Seed from trees originating from the Risdon and Calverts Hill stands has been collected for long term conservation storage at the Tasmanian Seed Conservation Centre based at the Royal Tasmanian Botanical Gardens.
- The Parks and Wildlife Service have taken action to reduce the risk of the Risdon stand being burnt by illegally lit fires, a firebreak has been established to protect the Calverts Hill stand.
- Through the efforts of Pipe Clay Coast Care Group and the Understorey Network, a number of conservation plantings have been made on private land in the vicinity of Calverts Hill using locally sourced seed (collected under permit) to address fragmentation and to establish wildlife corridors.
- Plantings have been made to supplement the Calverts Hill stand.
- Fences and cages have been constructed and maintained to protect natural and planted seedlings from browsing at Calverts Hill, possums caught in the fenced areas have been relocated, and remaining mature trees

have been banded to prevent damage from possums.

- Groups including staff and students from the University of Tasmania, NRM South and Wildcare's Threatened Plants Tasmania have been involved in survey and monitoring actions at Calverts Hill.
- The Department of State Growth is implementing measures to encourage recruitment away from the road verge in the South Arm Road/Delphis Drive stand through land acquisition, fence relocation and weed management.
- A Threatened Species Recovery Fund project to recover the Calverts Hill stand following its catastrophic decline is being implemented.

What is needed?

Agencies, groups or individuals may assist with some or all of the following recovery actions. Coordinated efforts may achieve the best and most efficient results.

- implement the actions detailed in Threatened Species Recovery Fund project, such as:
 - protect surviving trees, seedlings and plantings in the Calverts Hill stand from vertebrate and insect browsing,
 - supplement plantings at Calverts Hill,
 - include the species in Greening Australia's *Eucalyptus* restoration trials in sites that are projected to be within the future climate envelope of the species,
 - control invasive grasses,
 - supplement seed conservation holdings from trees originating from the Calverts Hill stand,
 - supplement seed conservation holdings from the Cremorne lowland remnants.
- monitor wild and ex situ stands and manage as appropriate;
- implement measures to control serrated tussock in the Calverts Hill Nature Reserve and to prevent spread of Chilean needle grass into the remnant stands of the Cremorne subpopulation;

- conduct a census of plants in the small remnant stands of the Cremorne subpopulation;
- maintain conservation plantings and seed holdings;
- establish seed conservation holdings for the smaller remnant stands;
- supplement the conservation seed holding of the Risdon subpopulation;
- consider a buffer planting at Calverts Hill of more drought tolerant eucalypt species to address edge effects;
- reduce competition in the Risdon stand when needed;
- encourage an ecological burn in the Risdon site and supplement the stand if burnt, through sowing or planting;
- consider culling planted hybrids (do not cut down naturally occurring hybrids);
- consider culling noisy miners at Calverts Hill if monitoring demonstrates that their numbers are reducing bird diversity onsite;
- pursue uplisting to Critically Endangered on schedules of the *Environment Protection and Biodiversity Protection Act 1999*.

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Contact details: Threatened Species Section, Department of Primary Industries, Parks, Water and Environment, GPO Box 44 Hobart Tasmania Australia 7001.

threatenedspecies.enquiries@dpiwwe.tas.gov.au

Permit: It is an offence to collect, disturb, damage or destroy this species unless under permit.