GLIDERS

Feathertail glider

Greater glider

Sugar glider

Yellow-bellied glider

CONSERVATION ACTION STATEMENT

September 2010

I ♥ BNE
That's why I'm taking action to conserve our wildlife.

BRISBANE CITY

Dedicated to a better Brisbane

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- Feathertail glider, *Acrobates pygmaeus*, ©Queensland Museum, Gary Cranitch.
- Greater glider, *Petauroides volans*, ©Queensland Museum, Gary Cranitch.
- Sugar glider, *Petaurus breviceps*, ©Queensland Museum, Gary Cranitch.
- Yellow-bellied glider, *Petaurus australis*, Michael Snedic.

1 Introduction

This Conservation Action Statement addresses the following gliding possum species, collectively referred to as gliders, which are identified (with the exception of the feathertail glider *(Acrobates pygmaeus)*) as significant species within Brisbane, as per Council's Natural Assets Planning Scheme Policy (Brisbane City Council 2000):

1. Feathertail glider *(Acrobates pygmaeus)*.[1]
2. Greater glider *(Petauroides volans)*.
3. Sugar glider *(Petaurus breviceps)*.
4. Yellow-bellied glider *(Petaurus australis)*.

The squirrel glider (*Petaurus norfolcensis*), which is also part of this group is addressed under its own Conservation Action Statement (Council 2005).

This Conservation Action Statement will be updated as new information becomes available and to report progress on conservation actions. For more information about this or any other Conservation Action Statement, visit Council's website at **www.brisbane.qld.gov.au** or phone Council on **(07) 3403 8888**.

Aims

This Conservation Action Statement details Council's management intent for the long-term protection and conservation of significant gliders within Brisbane through the following actions:

- Collating **existing information** on the distribution, ecology and management requirements of these species within Brisbane and surrounds.
- Identifying **key threats** that significantly impact upon these species within Brisbane.
- Identifying **gaps in existing knowledge** of the habitat and management requirements of these species and research priorities.
- Detailing **practical and affordable strategies and actions** that support the long-term protection and conservation of these species within Brisbane.

[1] This document follows the nomenclature provided by the Commonwealth Department of Water, Heritage and the Arts' online 'Australian Faunal Directory' (DEWHA 2010), which is kept up to date with taxonomic revisions and provides a single, categorical point of reference for both common names and scientific names for all Australian taxa.

2 Conservation status

The conservation status of a species will influence how it is managed. 'Threatened' species are typically accorded a more stringent management regime than 'common' species. Various conservation registers identify the status of fauna species at local, state and national levels. The current conservation status of these gliders is provided in Table 1.

Table 1: Official conservation status of Brisbane's gliders

Species	Brisbane City[1]	South East Queensland[2]	Queensland[3]	National[4]
Feathertail glider	Not listed	Not listed	Least concern	Not listed
Greater glider	Significant: species in decline	Regionally significant priority taxa	Least concern	Not listed
Sugar glider	Noteworthy: uncommon in Brisbane	Not listed	Least concern	Not listed
Yellow-bellied glider (southern subspecies)	Extinct: believed to be extinct in Brisbane City	Regionally significant priority taxa	Least concern High priority[5]	Not listed

[1] Brisbane City Council 2000, *Brisbane City Plan 2000*, Natural Assets Planning Scheme Policy, vol. 2 [2] Significant for South East Queensland Bioregion under the Biodiversity Assessment and Mapping Methodology (Environmental Protection Agency 2002) [3] Queensland *Nature Conservation (Wildlife) Regulations 2006* under the *Nature Conservation Act 1992* [4] *Environment Protection and Biodiversity Conservation Act 1999* [5] Queensland Department of Environment and Resource Management 'Back on Track' species prioritisation framework.

3 Distribution[2]

National/state

Feathertail glider

- Widespread in the cool-temperate and tropical eucalypt forests of eastern Australia to South Australia (Menkhorst and Knight 2001).
- Broadly distributed throughout the open mixed dry eucalypt forests of southern Queensland (Eyre 2004).

Greater glider

- Locally common in wet sclerophyll forests on the ranges and coastal plains from near Mossman in north-east Queensland, to Daylesford, Victoria (Menkhorst and Knight 2001).
- Widely distributed throughout the tall open forests and woodlands of southern Queensland, except for the drier woodland areas towards the south and south-west of the Brigalow Bioregion (Eyre 2004).

Sugar glider

- Common and widespread in wet and dry sclerophyll forest and woodland from the cool-temperate south-east (Victoria), New South Wales, and the wet and dry tropical north (Queensland, Northern Territory and Western Australia).
- Has been introduced to Tasmania (Menkhorst and Knight 2001).
- Found in a range of habitats in southern Queensland, including rainforest, wet and dry sclerophyll forests and eucalypt woodlands, but is more common in the tall open mixed eucalypt forests (Eyre 2004).

Yellow-bellied glider

- Patchily distributed in wet and dry sclerophyll forest from north Queensland to near Melbourne, with isolated populations in the Otway Range and far south-west Victoria (Goldingay 2008).
- Although widely distributed, populations of southern Queensland appear to be highly localised and disjunct (Eyre 2002).

Local

Feathertail glider

- Poorly studied in South East Queensland and little is understood of their distribution.
- Database records from Brisbane indicate this species is most commonly present within the bushland of the western suburbs around Kenmore and Brookfield and the south-eastern suburbs of Nathan (Toohey Forest) and Karawatha, and the rural residential suburbs of Burbank, Capalaba West, Gumdale and Mackenzie.
- Forested far western reaches of the city (Banks Creek, England Creek, Enoggera Reservoir, Pullenvale and Lake Manchester) show few or no records of the species, which is likely to be a result of poor search effort and reporting.
- Occurs in a wide range of habitat types, with the highest densities found in communities providing good supplies of nectar and pollen throughout the year, adequate understorey cover and suitable nesting sites (Fleming and Frey 1984; Turner 1985).
- More common in wet and old-growth forest than dry or regenerating ones (Menkhorst and Knight 2001).

[2] Unless otherwise stated, the information in this section is compiled from BAAM (2005).

3 Distribution continued...

Local continued...

Greater glider

- Database records from Brisbane show this species is most commonly present in the bushland of the western suburbs of Brookfield, Kenmore, Mt Coot-tha and Pinjarra Hills, within the Oxley Wedge at Doolandella, Karawatha, Toohey Forest and the eastern suburbs of Belmont, Burbank and Mackenzie.
- Also reported from Parkinson (BAAM 2002) and Mt Petrie (LAMR and GIA 2000).
- The most important factor in the presence of greater gliders and yellow-bellied gliders within the dry sclerophyll forests of South East Queensland are the higher proportions of spotted gum *(Corymbia citriodora)* and forest red gum *(Eucalyptus tereticornis)* (Wormington *et al*. 2002).

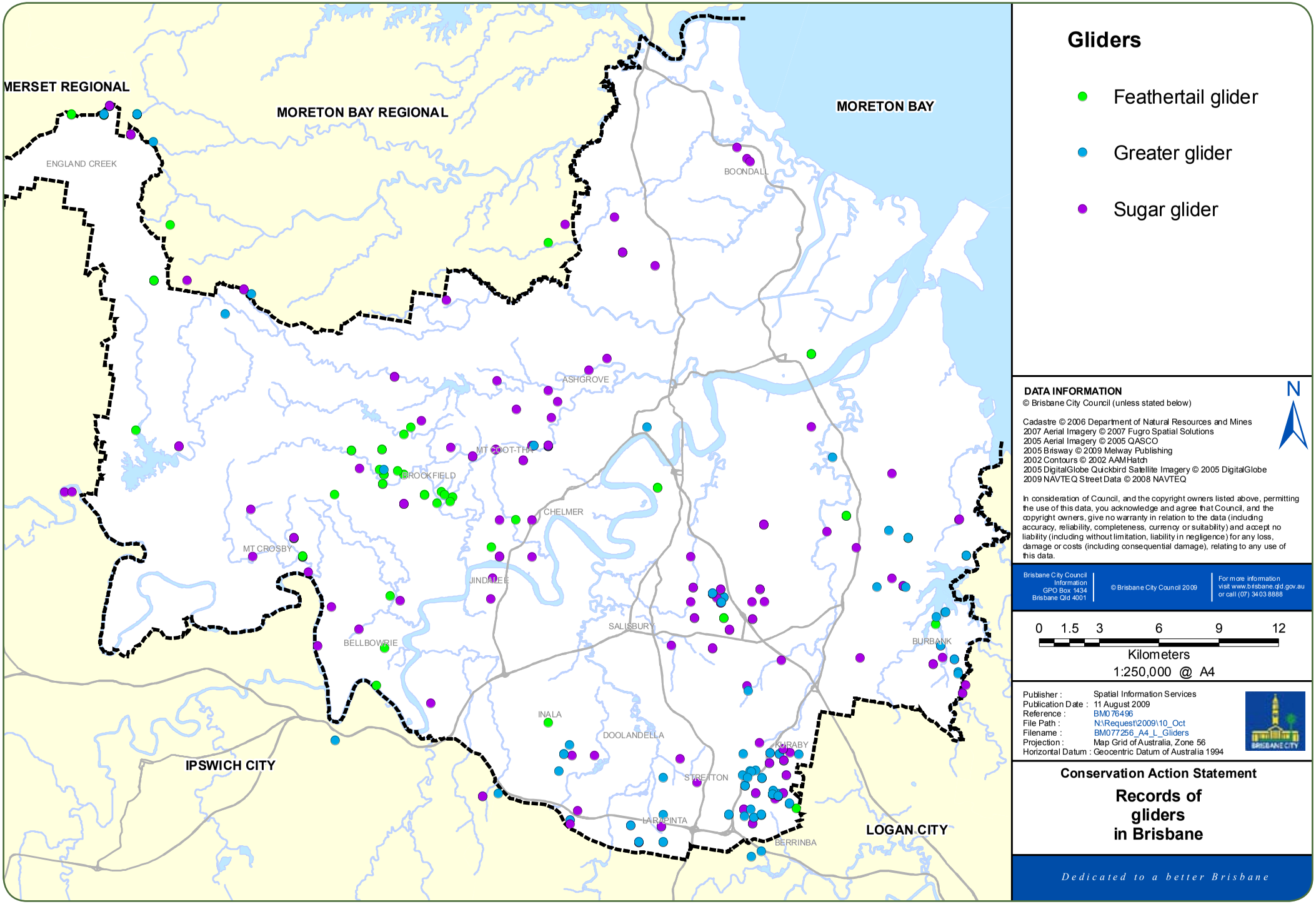
Sugar glider

- Database records from Brisbane show this species is most commonly present in the bushland of the western suburbs of Brookfield, Kenmore Hills, Mt Coot-tha and The Gap, the Boondall Wetlands, the northern suburbs of Bridgeman Downs and Chermside, Toohey Forest and surrounding suburbs, Karawatha, the south-western suburb of Bellbowrie, and the eastern rural residential suburbs of Burbank, Capalaba West and Chandler.
- The forested far western reaches of the city (Banks Creek, England Creek, Enoggera Reservoir, Lake Manchester and Pullenvale) show few or no records of the species, which (as for the feathertail glider) is likely to be a result of poor search effort and reporting.
- There are records from Pinjarra Hills (BIS 2001).
- The density of understorey acacia has been shown to influence density and distribution of sugar gliders in South East Queensland.
- A higher proportion of spotted gum was associated with the presence of sugar gliders and yellow-bellied gliders (Wormington *et al.* 2002)
- Spotted gums shed their bark during spring. In New South Wales and Victorian studies a link has been shown between the amount of shedding bark and the diversity of arboreal marsupials (Lindenmayer *et al.* 1991). The most likely reason is because the shedding bark helps petaurus gliders find arthropods (Henry and Suckling 1984).

Yellow-bellied glider

- There is one historical record for this species at Belmont.
- The continuous forested area of D'Aguilar Natonal Park, however, has potential to support this species within Brisbane, both now and in the future.
- Yellow-bellied gliders prefer habitat where there are spotted gums (Eyre and Goldingay 2003) and winter flowering tree species (Kavanagh 1987; Goldingay 1990).

Verified glider records for Brisbane are shown on Map 1.



Gliders

- Feathertail glider
- Greater glider
- Sugar glider

DATA INFORMATION

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Kilometers
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Reference : BM076496
File Path : N:\Request\2009\10_Oct
Filename : BM077256_A4_L_Gliders
Projection : Map Grid of Australia, Zone 56
Horizontal Datum : Geocentric Datum of Australia 1994

Conservation Action Statement

Records of gliders in Brisbane

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4 Ecology[3]

Habitat

These species are all hollow-dependant and therefore are only found in habitats which contain hollow-bearing trees. Hollow-bearing trees are therefore good indicators of habitat quality.

Feathertail glider

- Currently there is limited knowledge of the ecological requirements and habitat preferences in southern Queensland.
- Although hollow-dependent for nesting and shelter, its small size (10-16 grams) suggests that it can utilise hollows with smaller diameter entrances, which tend to be more abundant in natural forest ecosystems (Eyre 2004, Goldingay *et al.* 2007).
- In South East Queensland, it has also been found to inhabit farm forestry plantations of regrowth hardwood species when provided with nest boxes (Kirk *et al.* 2000; Borsboom *et al.* 2002; Smith and Agnew 2002, Goldingay *et al.* 2007).
- As many as twenty-five individuals have been found nesting together, however this is unusual (MacDonald 1984). Such groups employ huddling to keep warm in cold conditions (Frey and Fleming 1984).
- Has also been observed foraging at heights from ground level to 40 meters above the ground.
- Height of foraging found to be dependent on species of tree and abundance of food, but independent of season (Goldingay and Kavanagh 1995).

Greater glider

- Found in a wide range of forest types in southern Queensland, but is most common in the high elevation, moist eucalypt forests.
- Shows a preference for the moderately-productive dry mixed eucalypt forests dominated by forest red gum *(E. tereticornis)*, spotted gum *(C. citriodora)* and grey gum species (*E. longirostrata* and *E. biturbinata*) (Eyre 2002, Wormington *et al.* 2002). The range for these grey gum species does not extend to the Brisbane area however, it is expected that locally occurring grey gum species *E. propinqua* and/or *E. major* would fulfil the same role.
- Forest red and spotted gums have been recorded as important den tree species in Queensland (Kehl and Borsboom 1984, Comport *et al.* 1996). In the local area, greater gliders have been observed using scribbly gum *(E. racemosa)*, tallowwood *(E. microcorys)* and pink bloodwood *(Corymbia intermedia)* (Adrian Caneris, [BAAM], 2009, pers. comm. 10 December).
- Generally solitary and spend most of the night-time feeding and perching in the upper canopy (Cunningham *et al.* 2004).
- Hollow-bearing trees appear to be the most important factor in habitat selection in southern Queensland. A minimum of two to four live den trees for every two hectares within preferred habitat is required (Kehl and Borsboom 1984; Eyre 2002).
- Although greater gliders have a relatively small home range they are reported to be absent from forests with fewer than six habitat trees per hectare (ARCS 1999).

[3] Unless otherwise stated, the information in this section is compiled from BAAM (2005).

4 Ecology continued...

Habitat continued...

Sugar glider

- Found in a range of habitats in southern Queensland, including rainforest, wet and dry sclerophyll forests and eucalypt woodlands, but it is more common in the tall open mixed eucalypt forests (Eyre 2004).
- Also the small (0.5-3.8 hectare) home range facilitates its persistence in fragmented habitat (Suckling 1984, Quin 1995).
- In South East Queensland, the abundance of acacia species in the understorey appears to be the most important habitat feature determining the distribution of the species (Wormington *et al.* 2002) because they are an important food source.
- Hollow-bearing trees are essential for denning purposes (Henry and Suckling 1984).
- However, hollow-bearing trees don't appear to be a major limiting factor in habitat selection because they can utilise a wide range of hollow-bearing tree size classes and characteristics (Lindenmayer *et al.* 1990).
- Are known to use artificial nesting sources such as nest boxes.
- In Victoria, the provision of nest boxes allowed successful reestablishment in a forest where hollow-bearing trees were absent (Suckling and Macfarlane 1983, Beyer and Goldingay 2006).

Yellow-bellied glider

- In southern Queensland habitat selection is based on the floristic composition of the overstorey.
- Clear preference is shown for forest types dominated by gum-barked and winter flowering eucalypt species, which provide continuous exudates and invertebrate foraging opportunities (Goldingay 1986, Kavanagh 1987, Eyre and Smith 1997, Eyre 2002).
- Preferred habitat is dry eucalypt forests dominated by forest red gum *(E. tereticornis)*, spotted gum *(C. citriodora)* and grey gum species *(E. longirostrata and E. biturbinata)* (Eyre and Smith 1997, Eyre 2002, Wormington *et al.* 2002). The range for these grey gum species does not extend to the Brisbane area however, it is expected that locally occurring grey gum species *E. propinqua* and/or *E. major* would fulfil the same role.
- Within these preferred habitat types, an increased proportion of large mature trees, site productivity, hollow-bearing trees and trees which shed bark in strips are important features in habitat selection in southern Queensland.
- Critical elements of habitat include sap-site trees, mature trees suitable for den sites and a mosaic of different forest types (Kavanagh 1987, Goldingay and Kavanagh 1991).

Artificial habitat - nest boxes

Tree hollows are an important part of the natural ecosystem and are a valuable resource for our native wildlife. Gliders are not the only species that are dependent on this scarce resource. Native birds, bats and other arboreal mammals also depend on tree hollows (QPWS 1990). Several studies have identified that a density of four hollow-bearing trees/ha is sufficient to sustain the diversity of arboreal mammal populations in South East Queensland (Wormington *et al.* 2002, Maloney *et al.* 2002). However, some species, such as the greater glider, have been known to utilise many more tree hollows to survive (Council, 'Guideline for the provision of nest boxes').

Unfortunately, due to loss of habitat many potential nesting sites have not retained a sufficient number of trees with hollows to allow for viable populations of gliders or other fauna to exist. As such, the provision of artificial nesting boxes can help species survive by providing artificial hollows for breeding and shelter (Beyer and Goldingay 2006, Goldingay *et al.* 2007).

4 Ecology continued...

Artificial habitat - nest boxes continued...

Table 2 below provides information about the dimension requirements for nest boxes for use by glider species. Entrance sizes need to be big enough to allow the intended species to enter. Many designs are available and it is even possible to purchase glider nest boxes from the internet. For more detailed information on the provision of nest boxes for gliders and other hollow-dependant species contact Council on (07) 3403 8888.

Table 2: Nest box dimensions required by glider species in Brisbane

Species	Inside measurement (mm)	Depth of box from bottom of entrance hole (mm)	Entrance diameter (mm)	Height above ground (m)	Comments
Feathertail glider	Top 150 x 150 Bottom 150 x 20 (wedge shaped)	300	15-20	2-5	Wedge-shaped box with bottom entry hole/slot. Species can use up to 5 hollows.
Sugar glider	150 x 200	300	30	2-5	2-5 nest boxes may be required per colony.
Greater glider	250 x 250	400	80	unknown	Jagged spout entrance. Species can use from 2-18 hollows.
Yellow-bellied glider	250 x 350	400	50-70	unknown	Species often utilises several den trees.

Where to place nest boxes?

Nest boxes should be placed where gliders have previously been recorded but where the scarcity of natural nesting hollows may limit the population. Strategic placements include ecological corridors (linking bushland remnants), areas of wildlife-human conflict, away from high traffic areas to limit road kill, areas with surrounding vegetation, priority areas (areas that are known to have less than 4-6 hollow bearing trees/ha) and particularly, overlapping priority areas (Council, 'Guideline for the provision of nest boxes'). It is also important to carefully consider the positioning of the nest box to ensure that it will not be exposed to full sun during the hottest hours of the day, nor overly exposed to wind and rain. Durant (2009) found that habitat features including structure and composition of vegetation and nest box factors such as density and length of time established all influenced the use of artificial nestboxes by arboreal mammals in a peri-urban landscape.

Diet

Sugar gliders and feathertail gliders focus their feeding behaviour on arthropods, nectar and pollen. At some locations sugar gliders will also feed extensively on eucalypt sap and gum from acacias. By far the most important food trees utilised by greater gliders and yellow-bellied gliders are the spotted gum *(C. citriodora)*, forest red gum *(E. tereticornis)* and grey gum species *(E. longirostrata and E. biturbinata)*. The range for these grey gum species does not extend to the Brisbane area however, it is expected that locally occurring grey gum species *E. propinqua* and/or *E. major* would fulfil the same role. These eucalypt species are not only critical food trees but can also be used for nesting purposes. Landowners and managers should consider these critical food trees when conducting revegetation works or connecting habitat corridors in areas where gliders exist. Increased abundance of these tree species can result in higher abundance of gliders.

4 Ecology continued...

Diet continued...

Feathertail glider

- Feeds primarily on honeydew, manna, nectar, pollen and arthropods (Turner 1984, Huang *et al.* 1987, Goldingay and Kavanagh 1995).
- Most of the feeding behaviour involves eucalypts where they search under loose bark and glean foliage.
- Searching of loose bark suggests that honeydew and arthropods are food items.
- Foliage gleaning is suggestive of feeding on plant secretions, honeydew and arthropods (Goldingay and Kavanagh 1995).
- Nectar feeding can be dominant at some locations (Turner 1984).
- May play an important role in the pollination and, consequently, survival of many species of native plant (Turner 1984).

Greater glider

- Folivores with a diet consists almost exclusively of eucalyptus foliage.
- Prefers leaves with high levels of foliar nutrients (Fitzgerald 1984, Kavanagh and Lambert 1990). Both spotted and forest red gums tend to have higher nutrient levels.

Sugar glider

- Feeds on arthropods, gum from acacias, honeydew, manna and eucalypt sap, nectar and pollen.
- Have also been observed to lick the ends of banksia flowers to deliberately harvest pollen, which provides dietary protein (Goldingay *et al.* 1991).
- Can conserve energy in response to food shortages, by entering into a state of torpor. Torpor occurs when the animal slows its breathing and becomes very unresponsive, with its body temperature dropping down to almost that of its surroundings (Fleming 1980).
- Dietary flexibility is apparent, which emphasizes the importance of maintaining great floristic diversity in their habitats (Hume 2004).

Yellow-bellied glider

- Weighs up to 700 grams, making it the second largest glider occurring in Australia.
- Feeds predominantly on plant and insect exudates such as eucalypt sap, nectar, honeydew and manna (which satisfy energy requirements).
- Protein is obtained from arthropods and pollen (Smith and Russell 1982, Craig 1985, Goldingay 1990, Kavanagh 1987).
- A north Queensland study found that sap feeding accounted for more than 80 percent of the feeding observations throughout the year (Quin *et al.* 1996).
- Spotted gum *(C. citriodora)*, forest red gum *(E. tereticornis)* species, and in particular the grey gums *(E. longirostrata* and *E. biturbinata)*, are the preferred source of sap for yellow-bellied gliders in southern Queensland and north-east New South Wales (Eyre and Goldingay 2003, 2005). The range for these grey gum species does not extend to the Brisbane area, however it is expected that locally-occurring grey gum species *E. propinqua* and/or *E. major* would fulfil the same role.
- Eucalypt sap is obtained by using their teeth to create characteristic triangular incisions in the trunk and main limbs of selected trees and maintaining these wounds by regular chewing (Goldingay 2000, 2008).
- Foraging is also known to occur within a wide range of canopy heights.
- Eighty to ninety percent of the time that yellow-bellied gliders spend outside their nest hollows is devoted to foraging (Goldingay 1989).

4 Ecology continued...

Reproduction

Feathertail glider

- Can reach sexual maturity within one year following birth.
- In South East Queensland the species breeds from July to January, during which females usually produce two litters of three to four young (Menkhorst and Knight 2001).
- Young remain in the pouch for about nine weeks although, on average, one young is lost from each litter during lactation through natural causes or competition from other young (Ward 1990).
- Typically social groups are two to five individuals but up to 40 have been recorded from a single nest (Fleming and Frey 1984, Henry 1995).
- Closed spherical nests are typically constructed from eucalypt and acacia leaves, but will use leaves from other tree species (Fanning 1980).

Greater glider

- Breeds between March and June (Van Dyck and Strahan 2008).
- Do not breed until their second year (Tyndale-Biscoe and Smith 1969).
- Single young remains in the pouch until about four months old with weaning taking up to 7.5 months (Smith and Lee 1984).
- Only species of glider that does not live in a family group, with individuals marking out their territory using scent glands and only coming together for mating purposes.
- Generally nests in tree hollows (Kehl and Borsboom 1984, Comport *et al.* 1996).

Sugar glider

- Usually live for four or five years, but can live up to nine years in the wild, and may first breed as young as nine months (Van Dyck and Strahan 2008, Smith 1973).
- Oestrous cycle is 29 days with a gestation period of 16 days.
- Breeding seasons are generally timed to coincide with peak food availability at weaning.
- Litter size is usually two.
- Family/group size is known to be variable and seasonally dependent on the availability of resources.
- Nests for this species are cup-shaped and formed from green eucalypt leaves (Beyer and Goldingay 2006).

Yellow-bellied glider

- Individuals live for about six years (Goldingay and Kavanagh 1991).
- Age at first breeding is 15-24 months (Russell 1984).
- Breeds only once per year with a single young born between May and September.
- Young remains in the pouch for up to 100 days, after which time it stays in the nest while the mother forages.
- After leaving the pouch, the young is suckled for up to 60 days (Russell 1995).
- Varies in social group size, ranging from pairs in parts of Victoria, to multi-female or multi-male groups in New South Wales and Queensland (Goldingay *et al.* 2001).
- Variability in group structure may be related to the productivity of the site (Goldingay *et al.* 2001, Goldingay and Jackson 2004).
- Nests are a large bowl or ball shape constructed of eucalypt leaves (Gibbons and Lindenmayer 2002).

4 Ecology continued...

Reproduction continued...

Table 3: Breeding seasons (green shading indicates approximate breeding months)

Species	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Feathertail glider												
Greater glider												
Sugar glider												
Yellow-bellied glider												

Movement patterns

Gliding allows these species to move quickly throughout their home-range (Goldingay and Jackson 2004). Average gliding distance for each species increases with body size, ranging from 20 metres for sugar gliders to 40 metres for yellow-bellied gliders (Goldingay 1989).

Feathertail glider

- The feathertail glider is normally active at night. Occasionally the female, when rearing young, may be observed emerging to feed or drink during the late afternoon.
- Up to 90 percent of both males and females disappear from the population either through dispersal or mortality, before they reach maturity (Ward 1990).
- A typical home range is from 0.15 to 2.1 hectares, with individuals showing considerable site fidelity (Fleming and Frey 1984).
- Individuals make controlled glides of up to 25 metres (Menkhorst and Knight 2001).
- Males have been shown to move up to 600 metres from their first point of capture, but females are relatively sedentary (Fleming and Frey 1984).

Greater glider

- Generally appears to have a limited capacity for movement and dispersal, occupying small home ranges of one to three hectares (Henry and Suckling 1984, Kehl and Borsboom 1984, Comport *et al.* 1996).
- In southern Queensland models suggest that they require intact forest patches as large as 16,000 hectares (Eyre 2002).
- A study in southern Australia showed that this species can persist in a system of remnant patches of eucalypt forest. The optimum configuration of remnants was characterised by a relatively small number of large patches as opposed to a relatively large number of small patches (McCarthy and Lindenmayer 1999a).
- Patches larger than three hectares in size are also likely to contribute to species persistence in forests that are intensely managed for timber production (McCarthy and Lindenmayer 1999a).
- May require larger contiguous areas in poor productivity forests to maintain viable populations (Eyre 2004).

Sugar glider

- Strictly nocturnal and will range over an area of up to 7.1 hectares.
- Densities recorded at one study area ranged from 0.24 – 0.54 per hectare (Quinn 1995).
- Juvenile sugar gliders disperse at a mean age of 12.5 months (Quinn 1995).
- Individuals can glide up to 90 metres in a single leap (Menkhorst and Knight 2001).

4 Ecology continued...

Movement patterns continued...

Yellow-bellied glider

- Highly social and mobile animal (Russell 1984, Goldingay 1989).
- Can travel over two kilometres from the den to forage and can glide 140m in a single leap (Goldingay 1989, 2008).
- Extensive home range of 30-65 hectares (Goldingay and Kavanagh 1991).
- Suggests that this species does not require tree hollows in the same densities as the more sedentary arboreal marsupials (Eyre and Smith 1997).
- The spatial arrangement of late mature forest at the landscape scale is important for the species.
- Usage of hollow-bearing trees range from 0.16 to 4.4 per two hectares.
- Population modelling predicted that areas containing at least 150 glider groups are needed to support viable populations, with a minimum habitat area of 9750 hectares where all the forest is suitable habitat. Where only a portion of the habitat was suitable, between 18,000 and 35,000 hectares would be needed (Goldingay and Possingham 1995).
- In southern Queensland the minimum patch size of forested area has been observed to be approximately 31,600 hectares (Eyre 2004).

5 Threats[4]

Habitat loss, fragmentation and simplification

- Since European settlement an estimated 67,000 hectares or two-thirds of the original woody vegetation in Brisbane City has been cleared. This includes approximately 90% of lowland forests and more than 80% of all lowland vegetation (below 100m elevation). Habitat fragmentation is extensive – around 80% of the bushland remnants in the city are less than 20 hectares (Council 2001).
- Large home range requirements, populations occurring in low densities, a sedentary habit and specialised foraging and denning requirements indicate that these species are sensitive to land use practices and management activities. This has led to glider species being identified as possible indicator or umbrella species for effective management of forest-dependent fauna and associated habitat.
- Smaller remnants of habitat typically present sub-optimal breeding habitat conditions and potentially lead to increased nesting failures, reduced recruitment and possible population collapse. Studies have found that 8-12 habitat trees per hectare are needed to maintain hollow-dependent fauna populations (ARCS 1999).
- Increasing fragmentation and loss of connectivity between habitat remnants may effectively reduce foraging and breeding habitat.
- Replacement hollows in trees may take 200 years or more to form with different trees forming hollows at different rates. Replacement times for lost hollow-bearing trees cannot be accurately predicted (BAAM 2005).
- Small isolated populations are more prone to in-breeding, and increased risk of local extinction due to drought, fire and disease.
- Road-related deaths are likely to be an ongoing threat.
- Nest site disturbance by human-related activities are more likely in smaller disturbed habitats.

[4] Unless otherwise stated, the information in this section is compiled from BAAM (2005).

5 Threats continued...

Inappropriate fire regimes

- Smaller habitat patches, especially in urban landscapes are more prone to inappropriate fire regimes, weed invasion and subsequent changes to structural and floristic diversity. These changes create sub-optimal breeding and foraging conditions.
- Inappropriate prescribed burning regimes and windthrow reduce the number of standing dead trees which provide many of the hollows in South East Queensland for gliders (Eyre 2004).

Infrastructure

- Sugar gliders are susceptible to injury and death by barbed wire fencing (BAAM 2005).
- Powerlines and other linear infrastructure have been known to reduce the functionality of a gliding pathway but rarely form a barrier to gliding movement (Adrian Caneris [BAAM], 2010, pers. comm. 4 January).

Predation and competition

- Predation by cats, dogs, powerful owls, rufus owls, carpet pythons and dingoes observed for different glider species.
- Exotic pests such as the European honeybee and Indian myna use tree hollows for hives and nesting, reducing the availability of hollows for gliders.

Climate change

- Climate change will most probably result in the increased number and intensity of extreme weather events occurring in the future. Such stochastic events may lead to the extinction of small isolated populations of gliders.
- Gliders (apart from the greater glider) are extremely important pollinators, providing a crucial service to the ecologically significant trees in Brisbane. The continued transfer of pollen by gliders will help native flora species produce well adapted off-spring in light of climate change and the effects of a changing climate.The protection of pollinators, including three of the four glider species covered by this Conservation Action Statement, is of high importance.

6 Conservation

Several Council biodiversity initiatives are contributing to the protection and management of gliders and their habitat across the city. The following are key initiatives.

- Bushland Acquisition program. Through this program more than 2700 hectares of the city's most significant lowland habitats have been purchased and protected to date.
- Wildlife Conservation Partnerships program. More than 600 private properties have established conservation partnerships with Council, covering some 2000 hectares of principally lowland habitat in significant glider habitat areas.
- Conservation Reserve Estate. More than 13,700 hectares of parkland including 7755 hectares of bushland and wetland reserves are managed and protected. This reserve network provides habitat for Brisbane's significant species.
- *Natural Assets Local Law (2003).* Over 61,000 hectares of significant native vegetation is covered by the Natural Assets Local Law.
- *Brisbane City Plan (2000).* The *City Plan* designates a green space system throughout the city to recognise and protect the contribution of open space areas to ecological functions. The plan's Biodiversity Code and supporting Ecological Assessment Guidelines provide performance criteria and acceptable solutions to protect significant biodiversity values on, or adjacent to, proposed development. *City Plan* also includes statutory schedules of flora and fauna species considered significant in Brisbane. These schedules recognise the conservation significance of species at a citywide and/or regional level.

7 Research

There have been few detailed studies relating to these gliders in Brisbane or South East Queensland. Studies conducted elsewhere but relevant to Brisbane's gliders include the following.

- A study of habitat quality for gliders is a function of three habitat variables that describe the abundance of live and dead hollow-bearing trees and the biomass of foliage (McCarthy and Lindenmayer 1999b).
- A study showing that greater gliders exhibited high site tenacity and typically died in situ when forests within their home ranges were cleared, with very few animals moving to neighbouring areas of uncleared forest (Tyndale-Biscoe and Smith 1969).
- A study showing substantial past and continued loss of trees with hollows would not only reduce their suitability as permanent habitat for hollow-dependant taxa but also decrease the difficulty of successful dispersal between increasingly isolated habitat patches (Lindenmayer *et al.* 1990).
- A study predicting patches of remnant native eucalypt forest less than three hectares to be of limited value as habitat for greater gliders (McCarthy and Lindenmayer 1999a).
- A study into habitat alteration and reduction identifying the creation of barriers to movement and the reduction in size of forested areas to probably be the greatest long-term effects (Goldingay and Kavanagh 1991).
- A study showing any area that is wider than the distance over which an individual can glide (which is influenced by tree height) has the potential to act as a dispersal barrier (NSW NPWS 2003).
- A study showing localised extinctions of subpopulations of gliders in an array of small patches may, in turn, place a species at risk on a regional scale (McCarthy and Lindenmayer 1999a).

8 Management intent

Strategies

Council intends to contribute to the long-term conservation of the city's significant gliders through the following.

- Adopting and encouraging innovative voluntary and statutory mechanisms that protect important habitats and movement corridors.
- Securing and long-term protection of important habitat for gliders.
- Ensuring appropriate ecological assessment, reporting and survey procedures are adopted in development, planning and management activities.
- Encouraging land management practices that avoid, or minimise, direct and indirect impacts on gliders and their habitats on both public and private lands.
- Ensuring the timely availability of accurate, adequate and contemporary information for policy, planning and management decisions and actions.
- Facilitating research that targets priority information gaps and contributes positively to the conservation of Brisbane's gliders and their habitats.
- Providing the Brisbane community with appropriate information and opportunities to contribute in a practical way to better understand and protect Brisbane's gliders.
- Ensuring current retention and future adequate provision of hollow-bearing trees.

8 Management intent continued...

Actions

Table 4 describes priority conservation actions that Council will pursue with its partners to address the stated strategies. These priority actions have been drawn from studies undertaken for Council by recognised glider experts and from consultation with a range of stakeholders. Actions will be undertaken as funds become available through Council's budgetary process. It should be recognised that Council must consider the timing of these actions against other priorities across the whole of the city.

Table 4: Management actions

Management aspect	Action	Timing	Lead agent & key stakeholders[4]
Habitat protection	Conserve and protect important glider habitat on privately-owned land within Brisbane, through Council acquisition of significant habitat (Bushland Acquisition program) and through conservation partnerships with private landowners (Wildlife Conservation Partnerships program).	Ongoing	Council
Habitat management	Develop and introduce specific assessment criteria for developments and other potentially harmful activities occurring within or adjacent to known glider habitat. The glider species with the largest habitat requirements may be used to determine the minimum habitat guidelines for the glider species included within this Conservation Action Statement.	2011	Council
	Minimise the impact of habitat fragmentation as a result of linear infrastructure (such as roads and powerlines) through the installation of fauna-friendly wildlife movement infrastructure (such as glider poles and rope bridges).	Ongoing	Council, DTMR
	Undertake comprehensive control or eradication of any identified harmful or potentially harmful invasive pest species from known glider habitat.	Ongoing	Council
Research	Seek collaborative partnerships to undertake research that clarifies population status, identifies preferred habitat, minimum habitat patch size, connectivity requirements and minimum viable population size for gliders within the Brisbane area and examining within and between species associations/ interactions. In particular, undertake a review of conservation status of the yellow-bellied glider and feathertail glider in Brisbane.	Ongoing	Council, universities
	Seek collaborative partnerships for research to improve management uses of nest boxes for gliders, including preferred nest box designs.	Immediate and ongoing	Council, universities
	Investigate the use of gliders as an indicator or umbrella species in the management of bushland habitat in Brisbane, including examining the effects of fire on glider populations.	2011	Council, universities

[4] Council: Brisbane City Council, QM: Queensland Museum, DTMR: Queensland Department of Transport and Main Roads.

8 Management intent continued...

Actions continued...

Table 4: Management actions continued

Management aspect	Action	Timing	Lead agent & key stakeholders[4]
Information management	Develop a central database for the collation of monitoring data.	Underway	Council
	Update and refine essential baseline 'habitat requirement criteria' for populations based on monitoring data.	2012	Council
Community involvement	Support a glider identification workshop each year.	Commence 2010	Council, QM
	Incorporate glider habitat management information for landowners into community programs, including Wildlife Conservation Partnership program, Creek Ranger and Habitat Brisbane programs and environment centres curricula.	Underway	Council

Guidelines

The habitat protection and management guidelines detailed in Table 5 are provided to better assist environmental planners, land owners, land managers, private industry and the broader community to maintain and enhance existing glider habitat in Brisbane. These guidelines are preliminary and will be refined as more information about these species and their habitat requirements becomes available.

Table 5: Habitat protection and management guidelines

Issue	Guideline	Explanatory notes
Destruction/ clearing/ alteration of glider habitat due to development and localised invasions of invasive plant species.	Apply the Biodiversity Code, Ecological Assessment Guidelines, other relevant state legislation and any species-specific assessment criteria. Environmental impact assessments must account for glider requirements.	The guidelines provided within the existing codes are generally acceptable for most species, but may require refinement to maintain viable populations of gliders. Cleared areas positioned in a matrix of native forests must not be wider than the minimum gliding distances of species, as this may prevent dispersal between habitat patches. Assessment of impacts of proposed developments and activities should account for protection of glider habitat types and sap tree species; populations within highly fragmented habitat or urban and rural areas; size and shape of habitat, corridors and the fragmentation effects of infrastructure. Strategies should attempt to reduce edge effects, minimise foraging distances, increase the types of resources available and reduce the linear nature of the habitat (NSW NPWS, 2003). Area requirements for viable populations of gliders must also be determined, with habitat management and protection policies developed accordingly.

[4] Council: Brisbane City Council, QM: Queensland Museum, DTMR: Queensland Department of Transport and Main Roads.

8 Management intent continued...

Guidelines continued...

Table 5: Habitat protection and management guidelines continued

Issue	Guideline	Explanatory notes
Habitat restoration or rehabilitation.	Ensure appropriate restoration and management practices are enacted to enhance or at least maintain habitat quality. Food and nesting tree species selection and where appropriate, the use of nest-boxes should be considered.	Remnant areas need to be actively managed to reduce detrimental effects particularly weed management and tree recruitment and appropriate fire regimes. It is also highly desirable to enhance disturbed areas or recreate suitable habitats where appropriate, including the provision of nest boxes. Gliders are sensitive to habitat fragmentation through degradation of existing habitat and creation of dispersal barriers. Rehabilitation efforts should focus on reconnecting habitat through corridors, and protecting existing habitat. Critical trees for glider survival include the spotted gum (*C. citriodora*), forest red gum (*E. tereticornis*) and grey gum species (*E. propinqua* and *E. major*). Dependence upon resources that are represented in mature, old growth or older aged regrowth forests may further restrict this species' capacity to colonise new habitat (NSW NPWS, 2003).
	Ensure that where habitat removable is unavoidable, fauna friendly infrastructure is installed where appropriate.	The removal of vegetation from movement areas can be restored through the installation of wooden poles. The use of wooden poles where trees are removed or absent will consolidate gliding pathways. Any activities removing glider habitats should clearly demonstrate that distances between trees (and/or glider poles) will be sufficient to enable arboreal movements through habitat linkages without the need to cross ground. For example, the squirrel glider can glide at an angle of 20° from horizontal, enabling the launch height (h) required to cross a gap of width (d) to be described by $h = d \times \tan 20 + 2$ (2m being added to ensure target trees are reached and allow for intervening fences). Performance criteria (using the glide formula) will need to be established and reviewed by suitably qualified/experienced ecologist to assess the potential for successful movement. Extended fence posts can also be used to assist with glider movement options. In the short/medium term, tree plantings may need to be supplemented with glider poles to meet success criteria. If and when any of the above are identified as being required, they should be included as a condition for the activity.
Hollow retention	Ensure the minimum numbers of hollow-bearing trees are retained.	Although a large proportion of hollows may remain unused, this does not necessarily indicate the resource to be in excess, as many species will defend part, or all, of their home range, or nest site, from occupation by conspecifics and other species (Gibbons and Lindenmayer 2002). Some gliders are also known to utilise several hollows which they rotate throughout the season. When quantifying the number of hollow-bearing trees that need to be retained, it is important to take into consideration the temporal fluctuations of hollow usage.
	Promote use of artificial nest boxes in areas that would provide suitable habitat.	Refer Table 2 of this Conservation Action Statement. Contact Council for information about the provision of nest boxes. Nest boxes should not be considered as an equal substitute to natural hollow retention, however may be a viable alternative where hollow loss is unavoidable.

8 Management intent continued...

Guidelines continued...

Table 5: Habitat protection and management guidelines continued

Issue	Guideline	Explanatory notes
Edge effects	Prevent or minimise habitat fragmentation. Where possible, use parkland and vegetation buffers to soften transition from bushland to urban landscape.	Providing connectivity between habitat areas and minimising the degree to which bushland areas are impacted upon by development may mitigate edge effects. The impacts on populations of gliders from the primary threatening processes of transportation corridors, domestic animals and barbwire fences are all related to edge effects
Fire management	Maintain appropriate fire regimes within all known core habitat as close to those required for ecological outcomes and to minimise wildfire events.	Loss of hollow trees as den sites and loss of critical resources such as sap and pollen food trees is a known threatening process for gliders. Inappropriate fire regimes have the potential to destroy den trees and food trees and to reduce or remove native species recruitment. Implementing appropriate fire regimes that limit the intensity of burns will assist in the protection of den and food trees.
Pest animals	Wherever practicable, areas containing important habitat should be protected from invasive and domestic animals through invasive species control and eradication, fencing and community education.	Due to an increase in fragmentation of glider habitat, with isolated habitat situated at distances greater than species can glide to, individuals often have to move out of the safety of trees, putting them in danger of predation by these animals.

Further information

Agencies

- Brisbane City Council (www.brisbane.qld.gov.au).
- Department of Environment, Water, Heritage and the Arts (www.environment.gov.au).
- Queensland Department of Environment and Resource Management (www.derm.qld.gov.au).
- Queensland Museum (www.qm.qld.gov.au).
- Queensland Primary Industries and Fisheries (www.dpi.qld.gov.au).

Bibliography

Andren H 1994, *'Effects of habitat fragmentation of birds and mammals in landscapes with different proportions of suitable habitat: a review'*, Oikos 71: 355-366.

ARCS 1999, *Article on SEQ Regional Forests Agreement*, Australian Rainforest Conservation Society, (www.brisrain.webcentral.com.au/rfa.html).

BAAM 2002, 'Faunal assessment report: South Parcel, 3234 Beaudesert Rd, Parkinson, Queensland', Unpublished report prepared for Brisbane City Council, Biodiversity Assessment and Management, Brisbane.

BAAM 2005, 'Conservation Status review of gliders: Feathertail Glider (*Acrobates pygmaeus*), Greater Glider (*Petauroides volans*), Sugar Glider (*Petaurus breviceps*), Yellow-bellied Glider (*Petaurus australia australis*)', Unpublished report prepared for Brisbane City Council, Biodiversity Assessment and Management, Brisbane.

Beyer GL and Goldingay RL 2006, 'The value of nest boxes in the research and management of Australian hollow-using arboreal marsupials', *Wildlife Research*, 33: 161-174.

BIS 2001, 'Brisbane Independent School Submission', Unpublished report prepared by Brisbane Independent School, Pinjarra Hills for Appeal 4728/2001, Brisbane City Council – ats – Baptist Union of Queensland).

Borsboom AC, Wang J, Lees N, Mathieson M and Hogan L 2002, *Management and integration of fauna diversity values in Queensland agroforestry systems*, RIRDC Publication No. 02/044, Rural Industries Research and Development Corporation, Canberra.

Brisbane City Council, 'Guideline for the provision of nest boxes' (unpublished).

Brisbane City Council 2000, *Brisbane City Plan 2000, Natural Assets Planning Scheme Policy*, vol. 2, pp. 140-144, BCC, Brisbane.

Brisbane City Council 2001, *Brisbane State of the Environment Report 2001*, BCC, Brisbane.

Brisbane City Council 2005, *Squirrel Glider: Conservation Action Statement*, Brisbane City Council, Brisbane.

Comport SS, Ward SJ and Foley WJ 1996, 'Home ranges, time budgets and food-tree use in a high-density tropical population of Greater Gliders, *Petauroides volans minor* (Pseudocheiridae: Marsupialia)', *Wildlife Research*, 23: 401-419.

Craig SA 1985, 'Social organisation, reproduction and feeding behaviour of a population of Yellow-bellied Gliders *Petaurus australis* (Marsupialia: Petauridae)', *Australian Wildlife Research*, 12: 1-18.

Cunningham RB, Pope ML and Lindenmayer DB 2004, 'Patch use by the Greater Glider (*Petauroides volans*) in a fragmented forest ecosystem, III. Nite-time use of trees', *Wildlife Research*, 31: 579-585.

Daily G, Alexander S, Ehrlich P, Goulder L, Lubchenco J, Matson P, Mooney H, Postel S, Schneider S, Tilman D, Woodwell G 1997, 'Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems', *Issues in Ecology*, No. 2. A publication of the Ecological Society of America, Washington DC.

Davey SM 1984, 'Habitat preferences of arboreal marsupials within a coastal forest in Southern New South Wales' In: Smith AP and Hume ID (Eds.), *Possums and Gliders*, Surrey Beatty and Sons with Australian Mammal Society, Sydney, pp. 509-516.

DEWHA 2010, Australian Faunal Directory, Department of the Environment, Water, Heritage and the Arts, Canberra. www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa

Durant R, Luck G and Matthews, A 2009, 'Nest-box use by arboreal mammals in a peri-urban landscape', *Wildlife Research* 36:565-573.

Environmental Protection Agency 2002, *Biodiversity Assessment and Mapping Methodology*. Queensland Government, Brisbane.

Eyre TJ 1993, *Distribution, habitat and conservation status of the Yellow-bellied Glider Petaurus australis in southern Queensland*, Queensland Department of Primary Industries – Forest Service, Brisbane.

Eyre TJ 2002, *Habitat preferences and management of large gliding possums in southern Queensland*, PhD Thesis, Southern Cross University, Lismore.

Eyre TJ 2004, 'Distribution and conservation status of the possums and gliders of southern Queensland', In: *The Biology of Australian Possums and Gliders*, Goldingay RL and Jackson SM (Eds), Surrey Beatty and Sons, Chipping Norton, NSW, pp. 1-25.

Eyre TJ and Goldingay RL 2003, 'Use of sap trees by the yellow-bellied glider near Maryborough in southeast Queensland', *Wildlife Research*, 30: 229-236.

Eyre TJ and Goldingay RL 2005, 'Characteristics of sap trees used by yellow-bellied glider in southern Queensland', *Wildlife Research*, 32: 23-35.

Eyre TJ and Smith AP 1997, 'Floristic and structural habitat preferences of Yellow-bellied Gliders (*Petaurus australis*) and selective logging impacts in southeast Queensland, Australia', *Forest Ecology and Management*, 98: 281-295.

Fanning FD 1980, 'Nests of the feathertail glider, *Acrobates pygmaeus* (Burramyidae: Marsupialia), from Sydney, New South Wales', *Australian Mammalogy* 3: 55-56.

Fitzgerald AE 1984, 'Diet of the possum (*Trichosurus vulpecula*) in three Tasmanian forest types and its relevance to the diet of possums in New Zealand forests', In: Smith AP and Hume ID (Eds.), *Possums and Gliders*, Surrey Beatty and Sons with Australian Mammal Society, Sydney, pp. 137-143.

Fleming MR 1980, 'Thermoregulation and torpor in the sugar glider, *Petaurus breviceps* (Marsupialia: Petauridae)', *Australian Journal of Zoology*, 28: 521-534.

Fleming, MR and Frey H 1984, 'Aspects of the natural history of Feathertail Gliders (*Acrobates pygmaeus*) in Victoria', In: Smith AP and Hume ID (Eds.), *Possums and Gliders.* Surrey Beatty and Sons with Australian Mammal Society, Sydney, pp. 403-408.

Frey H and Fleming MR 1984, 'Torpor and thermoregularatory behaviour in free-ranging feathertail gliders (*Acrobates pygmaeus*) (Marsupialia: Burramyidae) in Victoria', In: Smith AP and Hume ID (Eds.), *Possums and Gliders.* Surrey Beatty and Sons with Australian Mammal Society, Sydney, pp. 393-401.

Gibbons P and Lindenmayer D 2002, *Tree Hollows and Wildlife Conservation in Australia*, CSIRO Publishing, Collingwood, Victoria, Australia, p. 105.

Goldingay RL 1986, 'Feeding behaviour of the yellow-bellied glider *Petaurus australis* (Marsupialia: Petauridae) in Bombala, New South Wales', *Australian Mammalogy*, 9: 17-25.

Goldingay RL 1989, 'Time budget and related aspects of the foraging behaviour of the yellow-bellied glider, *Petaurus australis*', *Australian Wildlife Research*, 16: 105-112.

Goldingay RL 1990, 'The foraging behaviour of a nectar feeding marsupial, *Petaurus australis', Oecologia*, 85:

191-199.

Goldingay RL 2000, 'Sap tree use by the yellow-bellied glider in the Shoalhaven region of New South Wales', *Wildlife Research*, 27:217-222.

Goldingay RL 2008, 'Yellow-bellied Glider *Petaurus australis'*, In: Van Dyck S and Strahan R (Eds.), *Mammals of Australia,* Reed New Holland, Sydney, pp 228-230.

Goldingay RL, Carthew SM and Whelan RJ 1991, 'The importance of pollination by non-flying mammals', *Oikos*, 61: 79-87.

Goldingay RL, Grimson MJ and Smith GC 2007, 'Do feathertail gliders show a preference for nest box design?', *Wildlife Research*, 34: 484-490.

Goldingay RL and Jackson SM 2004, 'A review of the ecology of the Australian Petauridae', In: Smith AP and Hume ID (Eds.), *Possums and Gliders*, Surrey Beatty and Sons, Sydney, NSW, pp. 376-400.

Goldingay RL and Kavanagh RP 1991, 'The Yellow-bellied Glider: a review of its ecology and management considerations', *Conservation of Australia's Forest Fauna*, Lunney D (Ed.), Royal Zoological Society of New South Wales, Mosman, pp. 365-375.

Goldingay RL and Kavanagh RP 1995, 'Foraging behaviour and habitat use of the feathertail glider (*Acrobates pygmaeus*) at Waratah Creek, New South Wales' in *Wildlife Research*, 22: 457-470.

Goldingay RL and Possingham H 1995, 'Area requirements for viable populations of the Australian gliding marsupial *Petaurus australis*', *Biological Conservation*, 73: 161-167.

Goldingay RL, Quinn DG and Churchill S 2001, 'Spatial variability in the social organisation of the yellow-bellied glider near Ravenshoe, north Queensland', *Australian Journal of Zoology*, 49: 397-409.

Henry SR 1995, 'Feathertail glider, *Acrobates pygmaeus* (Shaw, 1794)', In: Menkhorst PW (Ed.), *Mammals of Victoria: Distribution, Ecology and Conservation.* Oxford University Press, Melbourne, pp. 122-123.

Henry SR, and Suckling GC 1984, 'A review of the ecology of the Sugar Glider', In: Smith AP and Hume ID (Eds.), *Possums and Gliders*, Surrey Beatty and Sons, Sydney, NSW, pp. 355-358.

Huang C, Ward S and Lee AK 1987, 'Comparison of the diets of the feathertail glider, (*Acrobates pygmaeus*), and the eastern pygmy possum, (*Cercartetus nanus*) in sympatry', *Australian Mammalogy*, 10: 47-50.

Hume ID 2004, 'Diets and digestive strategies of possums and gliders', In: Smith AP and Hume ID (Eds.), *Possums and Gliders.* Surrey Beatty and Sons, Sydney, NSW, pp. 199-206.

Kavanagh RP 1987, 'Forest phenology and its effect on foraging behaviour and selection of habitat by the yellow-bellied glider, *Petaurus australis* (Shaw)', *Australian Wildlife Research*, 14: 371-384.

Kavanagh RP and Lambert MJ 1990, 'Food selection by the Greater Glider, *Petauroides volans*: Is foliar nitrogen a determinant of habitat quality?', *Australian Wildlife Research*, 17: 285-300.

Kehl J and Borsboom A 1984, 'Home-range, den tree use and activity patterns in the greater glider (*Petauroides volans*)', In: Smith AP and Hume ID (Eds.), *Possums and Gliders*, Surrey Beatty and Sons, Sydney, NSW, pp. 229-36.

Kirk J, Smith GC and Agnew G 2000, 'Trial radio-tracking of feathertail gliders *Acrobates pygmaeus, Australian Mammalogy*, 22: 129-131.

LAMR and GIA 2000, 'Development opportunities and constraints: Lands south of Mt Petrie: Flora and fauna values', Unpublished report prepared for Mt Petrie Landholders Group, by Landscape Assessment, Management and Rehabilitation Pty Ltd and Glen Ingram and Associates, Brisbane.

Lindenmayer DB, Cunningham RB, Tanton MT, Smith AP and Nix HA 1990, 'The conservation of arboreal marsupials in the montane forests of the central highlands of Victoria, south east Australia: I: Factors influencing the occupancy of trees with hollows', *Biological Conservation*, 54: 133-145.

Lindenmayer, D.B., Cunningham, R.B., Tanton, M.T., Nix, H.A. and Smith, A.P. 1991, 'The conservation of arboreal marsupials in the montane ash forests of the central highlands of Victoria, South-East Australia: III. The habitat requirements of leadbeater's possum *Gymnobelideus leadbeateri* and models of diversity and abundance of arboreal marsupials', *Biological Conservation*, 56: 295-316.

MacDonald D 1984, *The Encyclopaedia of Mammals*, *Volume 2*, George Allen and Unwin, Sydney.

Moloney D,Wormington K and DeStefano S 2002, *Stag Retention and Use by Arboreal Marsupials in Eucalypt Forests of Southeast Queensland, Australia: Implications for Management*, USDA Forest Service General Technical Report.

McCarthy MA and Lindenmayer DB 1999a, 'Conservation of the greater glider (*Petauroides volans*) in remnant native vegetation within exotic plantation forest', *Animal Conservation*, 2: 203-209.

McCarthy MA and Lindenmayer DB 1999b, 'Incorporating metapopulation dynamics of greater gliders into reserve design in disturbed landscapes' in *Ecology*, 80: 651-667.

Menkhorst P and Knight F 2001, *A field guide to Mammals of Australia*, Oxford University Press, USA.

NSW National Parks and Wildlife Service (NPWS) 2003, *Recovery Plan for the Yellow-bellied Glider (Petaurus australis)*, NSW National Parks and Wildlife Service.

Queensland Parks and Wildlife Service (QPWS) 1990, *Wildlife needs natural tree hollows*, Brisbane, QLD.

Quin DG 1995, 'Population ecology of the squirrel glider (*Petaurus norfolcensis*) and the sugar glider (*P. breviceps*) (Marsupialia: Petauridae) at Limeburners Creek, on the central north coast of New South Wales', *Wildlife Research*, 22: 471-505.

Quin DG, Goldingay R, Churchill S and Engel D 1996, 'Feeding behaviour and food availability of the Yellow-bellied Glider in north Queensland', *Wildlife Research*, 23: 637-646.

Russell R 1980, *Spotlight on Possums*, University of Queensland Press, St Lucia, Brisbane.

Russell R 1984, 'Social behaviour of the yellow-bellied glider, *Petaurus australis*, in north Queensland', In: Smith AP and Hume ID (Eds.), *Possums and Gliders.* Surrey Beatty and Sons with Australian Mammal Society, Sydney, pp. 343-353.

Russell R 1995, 'Yellow bellied glider *Petaurus australis* Shaw 1971', In: R Strahan (Ed.), *The Mammals of Australia*, Reed Books, Chatswood, NSW.

Smith MJ 1973, *Petaurus breviceps Mammalian Species No. 30: 1-5*, American Society of Mammalogists, United States.

Smith GC and Agnew G 2002, 'The value of "bat boxes" for attracting hollow-dependent fauna to farm forestry plantations in southeast Queensland', *Ecological Management and Restoration*, 2: 35-44.

Smith A and Lee AK 1984, 'The evolution of strategies for survival and reproduction in possums and gliders', In: Smith AP and Hume ID (Eds.), *Possums and Gliders*, Surrey Beatty and Sons with Australian Mammal Society, Sydney, pp. 17-33.

Smith A and Russell R 1982, 'Diet of the yellow-bellied glider *Petaurus australis* (Marsupialia:Petauridae) in north Queensland', *Australian Mammalogy*, 5: 41-45.

Suckling GC 1984, 'Population ecology of the sugar glider, *Petaurus breviceps*, in a system of fragmented habitats', *Australian Wildlife Research*, 11: 49-75.

Suckling GC and Macfarlane MA 1983, 'Introduction of the sugar glider *Petaurus breviceps*, into re-established forest of the Tower Hill State Game Reserve, Victoria', *Australian Wildlife Research*, 10: 249-258.

Taylor P 2004, *Southeast Queensland Bioregional Information Kit Environmental Protection Agency*, Queensland Government, Brisbane.

Tran C 2002a, *Best Practice Fire Management Manual – Operational Level Guidelines and Procedures*, Southeast Queensland Fire and Biodiversity Consortium, Brisbane, January 2002.

Tran C 2002b, *Individual Property Fire Management Planning Kit – Balancing fire safety with conservation of bushland Plants and Animals*, Southeast Queensland Fire and Biodiversity Consortium, Brisbane, February 2002.

Tyndale-Biscoe CH and Smith RFC 1969, 'Studies on the marsupial glider *Schoinobates volans* Kerr (II). Population structure and regulatory mechanisms', *Journal of Animal Ecology*, 38: 637-650.

Turner V 1984, 'Eucalyptus pollen in the diet of the Feathertail Glider, *Acrobates pygmaeus* (Marsupialia: Burramyidae)', *Australian Wildlife Research*, 11: 77-81.

Turner V 1985, 'The ecology of the eastern pygmy possum *Cercartetus nanus*, and its association with *Banksia*' Unpublished PhD thesis, Monash University, Melbourne.

Van Dyck S and Strahan R 2008, *The Mammals of Australia Third Edition*, Reed New Holland, Sydney.

Ward SJ 1990, 'Life History of the feathertail glider, *Acrobates pygmaeus* (Acrobatidae: Marsupialia) in south-eastern Australia', *Australian Journal of Zoology*, 38: 503-17.

Wormington KR, Lamb D, McCallum HI and Moloney DJ 2002, 'Habitat requirements for the conservation of arboreal marsupials in dry sclerophyll forests of southeast Queensland, Australia', *Forest Science*, 48: 217-227.