

**The Distribution and Status of the Squirrel Glider,
Petaurus norfolcensis, in the Thuroona area of Albury**



Photo by Lindy Lumsden

8 August 2003

**Report prepared by Rodney van der Ree for the
Albury-Wodonga Development Corporation**

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Acknowledgements

I would like to acknowledge the assistance of numerous people who facilitated the completion of this project, including Ian Davidson, John-Aker Jones, Glenda Datson, Craig Grabhams, and Peter Quin. Many people also provided information about their knowledge of Squirrel Gliders within the area, including Roger Merritt, Rob Fenton, Ian Davidson, Craig Grabhams, Damian Michael, Jonathon Howard, Rod Kavanagh and students from Riverina Tafe.

Summary

The landscape of the Thurogoona district of Albury is characterised by a mosaic of remnant *Eucalyptus* woodland, cleared farmland, scattered large old trees in paddocks and blocks of forward tree planting and areas of urban development. Remnant woodland occurs as strips along roadsides or streamsides, as many small patches in paddocks and a single large block (Bell's Travelling Stock Reserve). This patchwork of remnant and revegetated woodland provides habitat for the Squirrel Glider *Petaurus norfolcensis*. The Squirrel Glider is a small gliding marsupial whose primary habitat in south-eastern Australia is the woodlands of the south west slopes of NSW and northern plains of Victoria. Squirrel Gliders are listed as vulnerable in NSW and threatened in Victoria because a large proportion of their preferred habitat has been cleared for agriculture. Consequently, Squirrel Gliders are reliant on small and isolated patches of habitat for their survival.

Targetted surveys and consultation with local ecologists and naturalists recorded a total of 47 individuals, with most (39) being detected from 2002 - present. Twenty-one animals were trapped, eight were found occupying nest boxes, five were found dead on the Hume Highway, seven were found dead on barbed wire fencing, three were detected while stagwatching, two seen while spotlighting and one found dead on the ground. These records originate from across the Thurogoona Study Area within AWDC land and land reserved for the internal freeway, as well as in areas immediately adjacent to the Thurogoona Study Area. This collation of recent records strongly indicates that Squirrel Gliders are likely to be widespread across the district, with populations resident in the local area. Squirrel Gliders were predominantly found in mature remnant woodland, but also occurred in younger forward tree plantings where they contained large hollow bearing trees and / or suitable nest boxes.

The urban developments proposed for the Thurogoona area are likely to threaten the viability of local populations of Squirrel Gliders unless habitat protection and restoration works are implemented. These works must include:

- 1) Maintaining sufficient area of high quality habitat that contains food (nectar, pollen, invertebrates, sap) and shelter (large trees with hollows);
- 2) Maintaining habitat linkages or corridors for movement between the areas dedicated to Squirrel Glider conservation
- 3) Minimising anthropogenic causes of Squirrel Glider mortality, especially predation by pet cats and dogs, and death after collision with vehicles and barbed wire fencing.
- 4) Ensure that the impacts of urbanisation on Squirrel Gliders within Thurogoona is monitored in a long-term scientifically designed study. This will assist in achieving the conservation goals at Thurogoona as well as for other urban developments.

Introduction

The Squirrel Glider *Petaurus norfolcensis* is a small-medium sized (200 – 350 gm) gliding possum that was once common across large areas of eastern and southern Australia. Its preferred woodland habitat coincides with fertile soils, highly suited for agriculture. As a result, most habitat for Squirrel Gliders in south-eastern Australia has been cleared (Menkhorst *et al.* 1988). In particular, most of the woodlands on the inland slopes of the Great Dividing Range in New South Wales and Victoria have been cleared, and most remaining habitat occurs as small patches of woodland or as linear strips along watercourses and roadsides. In areas adjacent to cities and towns, the species may be further threatened by inappropriate urban development.

Incidental records of Squirrel Gliders from across the Thurooona area indicated the presence of the species in the district. However, there was insufficient information on the status of Squirrel Gliders from Thurooona to assess the potential impacts on the species of future land developments. The broad objective of this survey was to investigate the distribution of the species within the Thurooona area and provide recommendations on important habitat for the species. The specific aims were

- 1) Determine the distribution of Squirrel Gliders in the Thurooona area;
- 2) Identify key habitats for the species within the Thurooona area;
- 3) Identify key habitat linkages at the local (within the Thurooona area) and regional (from the Thurooona area to adjacent landscapes) scale;
- 4) Identify the major potential threats to the species; and
- 5) Input the results into the Thurooona Threatened Species Conservation Strategy (Davidson and Datson 2003)

Methods

The primary survey technique used in this study was trapping using wire cage traps (20 cm x 20 cm x 50 cm) placed on tree trunks at a height of 3 – 5 m above the ground. At two blocks of forward tree plantings, large Elliott traps (Elliott B) were also utilised. Traps were baited with a mixture of peanut butter, oats and honey, and a diluted mixture of water and honey was sprayed on tree trunks above traps to act as an attractant. Traps were left open at night and checked at first light each morning. Traps were placed in trees at intervals of approximately 100 – 200 m, either in a straight line along roadsides or watercourses or in a grid layout in larger blocks. Trap-trees were targeted towards trees of large diameter or as suitable take-off/landing trees to increase trap success. Each site was trapped for between 3 – 5 nights.

All nest boxes within the Thurooona area were checked once during the two-week survey period. The location, design and condition of all boxes were recorded. One spotlighting survey was also undertaken during the survey period

Other information was collated from a range of sources, including local ecologists, environmental consultants, staff and students from Charles Sturt University and Riverina Tafe (National Environment Centre), and staff from State Forests of New South Wales.

Results

Trapping effort

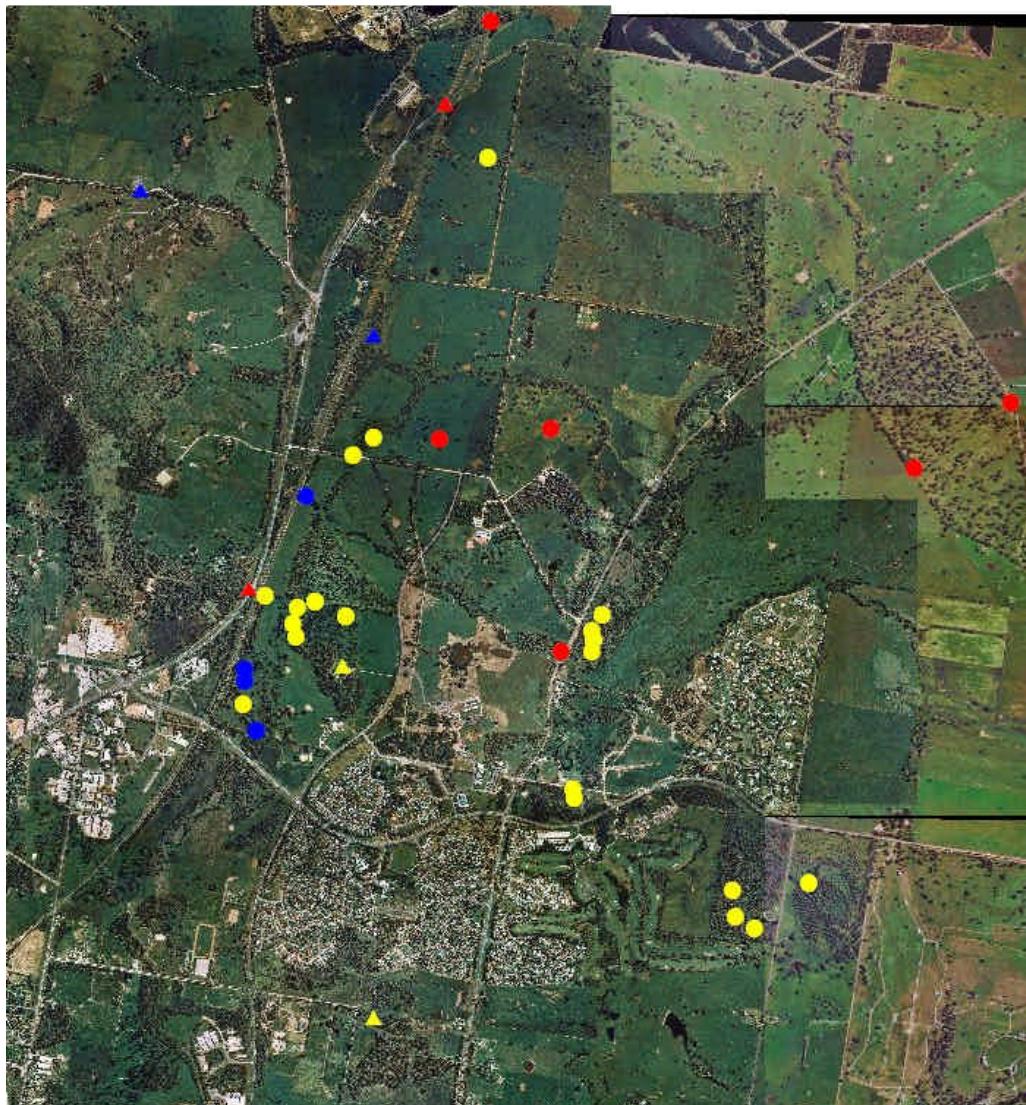
A total of 554 trap nights were expended during two trapping sessions of 6 and 8 days duration each, respectively. The first session was from the 17th – 22nd May 2003, and the second session was from 4th – 11th June 2003. Both trapping sessions were undertaken in weather conditions not conducive to high trap success. The May session was completed during thunderstorms and high rainfall, while the June session was characterised by gale-force winds and cold temperatures. Unfortunately, trapping sessions had either commenced prior to the inclement weather or could not be postponed within the timeframe of the study. Therefore, the results should be considered conservative and it is likely that Squirrel Gliders are both more abundant and more widespread than the trapping results suggest. The poor weather conditions also prevented more spotlighting being undertaken. The capture rate of Squirrel Gliders improved significantly as weather conditions improved at the end of each trapping session.

Capture success and other records of gliders

Records of Squirrel Gliders are widespread from across the Thurooona area (Fig. 1). These records originate from a range of survey techniques and incidental sightings including trapping, spotlighting, stagwatching, incidental sightings of animals dead on the ground, caught on barbed wire fences or killed on the Hume Highway, and animals found during nest box inspections. Records also come from a number of different observers, including local experts, environmental consultants, and as part of this dedicated Squirrel Glider survey.

Targeted trapping

A total of 17 animals were captured during this survey. An additional three animals were captured in April 2003 to the west of Kerrs Rd by Craig Grabhams (Grabhams and Datson, 2003) and in 2001, one individual was captured along a drainage line north of Ettamogah Road by Ian Davidson (Davidson, 2001). Other species captured include one Sugar Glider (*Petaurus breviceps*) in remnant woodland near Corrys Wood Estate and numerous Common Brushtail Possums (*Trichosurus vulpecula*) were captured throughout the study area.



LEGEND

- fencekill
- incidental obs.
- nest box
- ▲ road kill
- ▲ spotlit
- ▲ stagwatched
- trapped

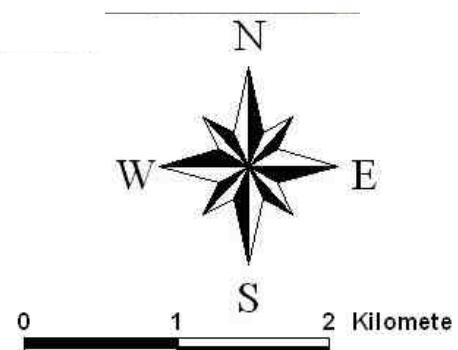


Figure 1. Distribution of Squirrel Gliders by survey technique within the Thurogoona district of Albury, 1996 – July 2003. Refer to Table 1 for more details of each record.

Map produced August 2003 by R. van der Ree

Nest Boxes

Twenty nest boxes were checked in the area adjacent to the powerline easement located west of the train line. Four boxes contained a combined total of eight gliders, with an additional box containing the skeletal remains of two juvenile gliders (large pouch young or just out of the pouch size). A further two boxes contained a nest of fresh eucalypt leaves, indicating the likely occupation of the box by Squirrel Gliders in recent weeks or months. Two boxes contained a single Common Ringtail Possum (*Pseudochirus peregrinus*) each and an additional two boxes contained a single Common Brushtail Possum (*Trichosurus vulpecula*) each. Two boxes were broken and the remaining seven boxes showed no signs of occupation.

Approximately 10 nest boxes were checked in the farm site of Riverina Tafe, and one contained a living Common Ringtail Possum and one contained a dead Common Ringtail Possum. The remaining boxes were empty. Approximately 15 nest boxes along the 8 Mile Creek north of the Kinross Hotel were inspected, and two contained fresh bowl-shaped nests of eucalypt leaves, indicating potential use by Squirrel Gliders. The remaining boxes along 8 Mile Creek were empty.

Barbed wire fences

Three Squirrel Gliders were positively identified from remains caught on barbed wire fences (Fig. 2). Two were found along Ettamogah Rd, including a juvenile female found alive in April 2003 that was euthenased and the remains of a Squirrel Glider tail that had been wrapped around the barbed wire for many months. This fur was identified microscopically as Squirrel Glider by Hans Brunner. The third Squirrel Glider was found on a fence in the mid 1990's by Peter Merritt (Manager, Norske-Skog Paper Mill) approximately 200 m N of the Billy Hughes Bridge.

Rob Fenton, a lecturer at Riverina Tafe, has found at least four gliders (identified to genus level only – i.e. either Sugar Glider or Squirrel Glider) on fences in the Thургоона area within the last 3 – 4 years. These animals are most likely Squirrel Gliders given the proportion of Squirrel Gliders to Sugar Gliders captured during this study.

Road kill

Five Squirrel Glider carcasses have been found on the east side of the Hume Highway between Thургоона Drive and the Ettamogah Pub by Peter Merritt. Three were found in early 2002, with two (including one male) from the Billy Hughes Bridge and the third near the rest stop approximately 1km south of Ettamogah Rd. This third animal was a female carrying two small pouch young. Two other animals were found between the Billy Hughes Bridge and Ettamogah Pub turn-off in the mid 1990's.

Stagwatching

The stagwatching survey technique involves observing animals at dusk as they leave the tree-hollow they occupied during the day. Rob Fenton detected Squirrel Gliders leaving a dead tree with hollows located east of the train line in November 2002 (Rob Fenton, pers. comm.). Two Squirrel Gliders were observed on the 30th and 31st May 2003 leaving the same hollow in a tree on Central Reserve Road by Damian Michael (pers. comm.).



Figure 2. Squirrel Glider caught on barbed wire fence. Photo by R. van der Ree.

Spotlighting

Limited spotlighting was undertaken for Squirrel Gliders as part of this survey, and one individual was seen in a forward tree planting block near Corry's Wood Estate in May 2003. In 2002, State Forests of New South Wales detected one glider while spotlighting in the central area of Thургоона near the property 'Noorly'.

Table 1. Number of Squirrel Gliders detected in the Thургоона area by survey technique. Refer to Figure 1 for location of each sighting.

Survey technique	Number of Squirrel Gliders detected	Date	Source
Trapping	17	May – June 2003	This survey
	3	April 2003	Graham and Datson 2003
	1	March 2001	Davidson 2001
Nest boxes	8	May – June 2003	This survey
Barbed wire fences	2	April – May 2003	This survey.
	1	mid 1990s	R. Merritt, pers. comm.
	4*	1999 – 2003	R. Fenton, pers. comm.
Road kill	5	mid 1990s – 2002	R. Merritt, pers. comm.
Stagwatching	2	May 2003	D. Michael, pers. comm.
	1	November 2002	R. Fenton, pers. comm.
Dead animal on ground	1	November 2002	Rod Kavanagh, SF NSW, pers. comm.
Spotlighting	2	November 2002 and May 2003	Rod Kavanagh, SF NSW, pers. comm. and this survey
Total	47		

*These four gliders are most likely Squirrel Gliders, however it was not confirmed.

Habitat use by Squirrel Gliders

Squirrel Gliders were detected or reported from within remnant woodland vegetation and forward tree plantings across large areas of the Thurooona Study Area and adjacent lands. The types of vegetation include woodland dominated by River Red Gum along watercourses, and woodland dominated by White Box, Yellow Box and Blakely's Red Gum along roadsides and in paddocks. Squirrel Gliders were also detected from scattered trees and small patches of trees within paddocks, and from within blocks of forward tree plantings. Forward tree plantings were only utilised by Squirrel Gliders if they contained suitable nest boxes or hollow-bearing trees.

Discussion

Status of the Squirrel Glider population at Thurooona

The Squirrel Glider population at Thurooona appears to cover a large proportion of the study area as well as occur nearby in adjacent landscapes (Fig. 1). The capture of individual gliders of all ages and both sexes indicates that reproduction and recruitment of young is occurring and that the population is likely to be viable, at least in the short term. Gliders are also likely to be permanent residents in most of the areas in which they were detected. Predictions of the long-term viability of the population are not possible without further demographic data. However, it is highly likely that the local population of Squirrel Gliders will become extinct if the habitat requirements of the species are not maintained within the proposed developments for Thurooona. In addition to habitat requirements, direct threats to individuals and the species needs also to be appropriately managed.

Habitat requirements of Squirrel Gliders at Thurooona

The primary habitat of Squirrel Gliders is woodland or forest. Squirrel Gliders are able to persist in relatively highly modified landscapes if sufficient high quality habitat remains (van der Ree 2002). The long-term survival of the species is reliant on the following key habitat components being available in sufficient abundance and at the appropriate spatial and temporal scales.

Amount of habitat

A major threat to the persistence of Squirrel Gliders at Thurooona is the loss of habitat for urban development. Any area of woodland that is cleared is less potential habitat for Squirrel Gliders. A reduction in habitat means fewer gliders in the local area, which increases the risk that the regional population may eventually become extinct. This may occur because a primary determinant of extinction risk is population size, because the fewer individuals are less able, as a population, to cope with chance events. For example, a smaller population is less able to cope with the loss of a few individuals due to disease than a larger one. Small populations are also likely to have a relatively reduced gene pool,

and thus may not possess the genetic diversity to cope with future environmental conditions. In other words, they do not have the genetic resources to adapt and survive future environmental changes such as climate change.

Linkages to other populations

Connectivity between habitats is important because it allows for the movement of animals and genes between populations. Habitat connectivity is important at different spatial scales, including between populations within the Thurogoona area, as well as between populations within and outside the Thurogoona area. Movement of animals between populations is important for two main reasons. First, new animals can disperse from other populations and arrive to increase the size of the receiving population. This is especially important if the receiving population is small, declining or has become locally extinct. Local extinction may occur if a fire or some other disturbance makes the local habitat temporarily unsuitable. The second important reason for maintaining or creating habitat linkages is that it allows for the movement of genes between populations, ensuring local populations do not suffer inbreeding depression or become “inbred”.

Habitat quality

Woodland or forest with a mix of Eucalypt species and shrubs typically provides the highest quality habitat for Squirrel Gliders. Mixed species ensures a more-continuous supply of nectar and other food resources across seasons. Important species of eucalypt for the Thurogoona area includes White Box, Yellow Box, River Red Gum, Red Box, Apple Box and Blakely's Red Gum. Although not indigenous to the local area, the flowering ironbarks and eucalypts with peeling bark in forward tree plantings may also provide quality food resources.

Tree hollows

Squirrel Gliders are completely reliant on hollows in trees for denning and raising of young. If trees containing hollows are removed from the landscape, gliders are unable to survive. An important point to note is that Squirrel Gliders, along with many other species of hollow-dependent fauna, require more than one hollow tree in which to live (van der Ree 2000). At Euroa in NE Victoria, Squirrel Gliders swapped den trees on average once every five days, and used up to 15 different den trees over an 80 day period (van der Ree 2000). And when animals swapped den trees, they moved to a tree that was approximately 250 m from the tree they occupied the previous day. Therefore, an important habitat component for Squirrel Gliders at Thurogoona will be the maintenance of a perpetual supply of suitable hollows distributed across all areas of potential habitat.

Nest boxes are a valuable tool that can act as a temporary replacement measure for the loss of naturally occurring tree hollows. Nest boxes may also provide

benefits for research or monitoring, and education. Regular inspection of nest boxes by trained personnel will provide data on the presence of the species, as well as the effectiveness of nest boxes. An important caution is that many animals will temporarily desert a nest box after it has been inspected, and too frequent checking may cause permanent abandonment. Another important consideration is that nest boxes have a limited lifespan, which may range from 1 to 10 years, depending on the prevailing weather conditions. Therefore, any nest boxes used to compensate the removal of hollow-bearing trees will need to be maintained until additional trees begin to develop hollows. This will require a financial commitment for > 120 years because it takes at least that length of time for many eucalypts to begin developing hollows (Gibbons and Lindenmayer 2002). Therefore, the recommended strategy is to maintain natural tree hollows wherever possible.

Direct threats to survival of Squirrel Gliders

Predation by introduced predators

Squirrel Gliders are a part of the ecosystem and are thus potential food for native predators, such as owls and goannas. However, Squirrel Gliders are also vulnerable to predation by cats and foxes, the density of which is likely to increase as Thургоона becomes more urbanised. The Albury City Council is strongly urged to make Thургоона a “cat-free” suburb, or at the very least, to impose a cat-curfew. Squirrel Gliders are not the only species of wildlife to benefit from this strategy, as many species of bird, reptiles and frogs are heavily preyed upon by cats. The use of the Squirrel Glider as a focal or emblem species for the area may increase the level of understanding of the issue and subsequently the rate of compliance.

Increased mortality due to anthropogenic causes

The most energy efficient means of travel for Squirrel Gliders is by gliding from tree to tree. Depending on the height of the tree, gliders can cover distances up to 80m, however 30 – 50 m is the average distance in typical blocks of woodland. When areas are cleared, gliders must make longer glides to cover the increased distances between trees. Consequently, they may end their glide on the trunk of a tree quite close to ground level. At night, when Squirrel Gliders are active, they may collide with the barbed wire fence often becoming entangled. Unable to free themselves, they eventually die due to dehydration or are scavenged by predators. This has been identified as a large problem in areas where gliders and barbed wire fences are common (van der Ree 1999). The detection of seven gliders at Thургоона on barbed wire fences strongly indicates that this may be a significant cause of mortality at Thургоона. Mortality due to barbed wire fences can be eliminated altogether by removing existing barbed wire fences and only erecting plain-wire fencing. If barbed wire fencing must be used,

the rate of entanglement can be reduced by replacing the top two strands (where most entanglements occur) with plain wire.

The extent of mortality of gliders due to collision with vehicles is largely unknown. However, five glider carcasses have been found nearby on the Hume Highway since 1995, with three of those being found in 2002. The problem is likely to be exacerbated if the Albury Bypass of the Hume Freeway extends through the western portion of the Thurogoona study area. Similarly, the problem of mortality after collision with vehicles is likely to increase as traffic volume across the Thurogoona area increases. Mortality can be minimised by keeping road width to a minimum and allowing trees to overhang the road, especially areas designated as Squirrel Glider habitat or linkages. This may enable gliders to glide across the road without coming to close to the ground where collision with vehicles is possible. In regards to the Albury Bypass, surveys must be undertaken prior to the design phase to identify the crossing locations and understand the gliding capability of gliders across a major road. Similar environmental issues are being faced by VicRoads along the Goulburn Valley Freeway in central Victoria.

Recommendations

The conservation of Squirrel Gliders within an urban context is a challenge because there have been no formal studies of the species within urban areas. However, the ability of gliders to persist in fragmented woodland within agricultural areas suggests that gliders may be able to survive provided the following key requirements are met.

- Sufficient area of high quality habitat is retained
- Trees with hollows are maintained **in perpetuity** across all areas designated as Squirrel Glider habitat. Hollows as nest boxes should also be provided in movement corridors to provide temporary denning habitat. Intuitively, linear strips that provide habitat are also likely to be the most effective as dispersal corridors.
- Corridors are retained for the movement and dispersal of Squirrel Gliders within the Thurogoona area, as well as connecting with habitat adjacent to Thurogoona
- Human-causes of mortality are kept to a minimum (road kill, barbed wire fences)
- Predation by pets (cats and dogs) is minimised.
- The effectiveness of these strategies at conserving biodiversity and threatened species is assessed into the future. This would involve surveys of particular species or groups of species over time in areas that have different development pressures (e.g. industrial vs rural vs residential). This is best undertaken by ecologists with training in understanding the impacts of urbanisation on biodiversity.

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