*Best practice guidelines*

# for the grey-headed flying fox

CMA Sydney Metropolitan Catchment Management Authority

FairfieldCity Celebrating diversity

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# 1 Introduction

Much of Sydney's native vegetation has been cleared or disturbed. As a consequence many native plants and animals have become locally extinct or threatened with extinction. These threatened species must be managed carefully to ensure their survival.

Cabramatta Creek Flying-fox Reserve contains severely degraded remnants of two endangered ecological communities listed under the *Threatened Species Conservation Act 1995* (NSW) (TSC Act): River Flat Eucalypt Forest and Swamp Oak Floodplain Forest. The reserve is also home to a significant maternity colony of the grey-headed flying fox (*Pteropus poliocephalus*).

The grey-headed flying fox, which once had a population of many millions, now numbers less than 300,000 nationally and continues to decline (DEC 2005). It is listed as a threatened species in 2001 in NSW (TSC Act), as a vulnerable species under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) and as a vulnerable species in Victoria. The aim of legislation is the protection and recovery of endangered species (Eby and Lunney 2002).

The Department of Environment and Climate Change NSW (DECC) and the Sydney Metropolitan Catchment Management Authority have identified the need to provide best practice guidance to land managers and private landholders seeking to conserve grey-headed flying foxes. Cabramatta Creek Flying-fox Reserve has been chosen as a demonstration site for this threatened species.

All flying-fox camp restoration projects should be managed to current best practice standards, as inappropriate restoration can significantly affect the usefulness of the camp. Land managers, private landowners and bush regenerators are encouraged to apply the strategies and techniques outlined in this document.

## 1.1 The grey-headed flying fox

The grey-headed flying fox is Australia's largest flying fox, with a head and body length of 23–29 cm and a wingspan of up to 1 m. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. It can be distinguished from other flying foxes by the leg fur which extends to the ankle.

Photo: B.Walters/DECC

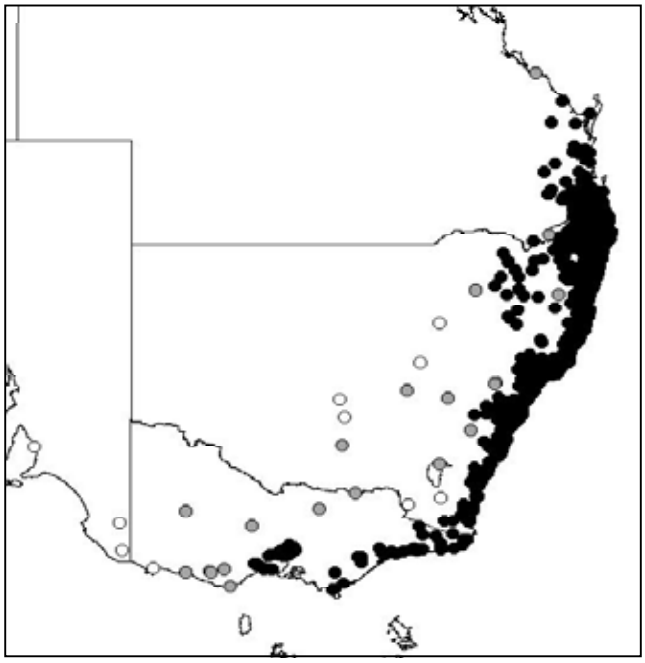
Grey-headed flying foxes

## 1.2 Distribution

The grey-headed flying fox is found along the east coast of Australia from Bundaberg to Melbourne. At any time the majority of the flying foxes will occupy only a small proportion of this range.

The northern range of grey-headed flying foxes is contracting to the south. In the late 1800s and early 1900s, they were recorded in far north Queensland. In 1929 there were camp sites occupied permanently or regularly around Rockhampton. Grey-headed flying foxes are no longer found in the Rockhampton area and known sites have contracted by approximately 300 km to the south.

Sightings of grey-headed flying foxes since 1984 are shown on the map below. There are few data from inland regions, and blank localities on the map cannot be interpreted as areas never occupied.



records from areas of repeated occupation (>1 record in a 40-km radius)

areas of unusual occupation (one record in a 40-km radius)

vagrants (records of individuals or small groups in unusual areas)

Distribution of the grey-headed flying fox

Sources: NSW Wildlife Atlas, DECC; Atlas of Victorian Wildlife, Victoria Department of Sustainability and Environment; WildNet, Queensland Parks and Wildlife Service; G. O'Brien, University of New England, unpublished data; T. Reardon, South Australia Museum, unpublished data; DECC, in preparation

Grey-headed flying foxes have expanded their southern range as shown by the permanent colonies in Melbourne and their recent appearance in South Australia. It has been hypothesised that the northern contraction and the southern expansion relates to temperature changes over the last 30 years, as the average temperature has increased by approximately 2–3°C across the range of the species. The adaptability of grey-headed flying foxes in exploiting a variety of food sources could also be a factor in the expansion of their southern range.

## 1.3 Ecological role of the grey-headed flying fox

Flying foxes act as pollinators and seed dispersers primarily of the genera *Eucalyptus*, *Syncarpia*, *Angophora*, *Melaleuca* and *Banksia*, but in some areas they also eat a range of rainforest fruit and consequently influence the reproductive and evolutionary processes of many forest types, including hardwoods (DECC, in preparation).

With the landscape becoming increasingly fragmented, this ecosystem service provided by grey-headed flying foxes has become vital. For example, in urban or cleared rural areas, while many bird and insect pollinators are effectively isolated in their fragmented patches of bush, the flying fox is not so constrained (Deeker and Burrowes 1994; Eby 1995).

## 1.4 Reproduction

Before grey-headed flying foxes were known to migrate over large distances, rapid increases in camp populations were believed to be due to high birth rates. This is not the case, as the reproduction of grey-headed flying foxes is a lengthy process which makes populations susceptible to decline (Rigden et al. 2000; McIlwee and Martin 2002). Female flying foxes have to be at least 2–3 years old to bear a single offspring, and reproduction takes 12 months from conception to independence (NPWS 2004).

Flying foxes give birth in the spring, around October–November. Young flying foxes are dependent on their mother until they are able to fly out of the camp with adults in summer (January–February). For the first two years of life flying foxes suffer a high rate of mortality, usually due to misadventure (Rigden et al. 2000).

## 1.5 Cabramatta Creek Flying-fox Reserve

The Cabramatta Creek Flying-fox Reserve demonstration site is located on the boundary of Cabramatta and Warwick Farm, approximately 30 km west of Sydney's CBD. It is 2.8 hectares bounded on three sides by Cabramatta Creek. It is also part of a 12-km riparian corridor along Cabramatta Creek which contains the majority of natural vegetation in the local area. Severely degraded remnants of River Flat Eucalypt Forest and Swamp Oak Floodplain Forest, as listed under the TSC Act as endangered ecological communities, comprise vegetation in the reserve.

Cabramatta Creek Flying-fox Reserve is home to a significant maternity colony of grey-headed flying foxes and also functions as a stopover point for grey-headed flying fox migrations along the east coast of Australia (FCC 2007). The little red flying fox (*Pteropus scapulatus*), another threatened species, is highly nomadic and is also known to use this site.

By 1988 enough roost trees allowed a small flying-fox camp to establish and, by 1995, more than 20,000 flying foxes were using the site. In the non-breeding season (winter), this number declines to 5,000 (CCFFC 2002).

Little of the original vegetation of the Cumberland Plain remains since the area was extensively cleared for grazing and small-scale farming. Today, the rapid spread of suburban subdivision threatens extant vegetation (Fairley and Moore 1995). A tall, close-growing open forest once covered most of the plain but now there are only scattered patches. Past land use, the location of the site on a flood plain, and subsequent soil studies suggest that the site has little resilience.

Grey box (*Eucalyptus moluccana*) and forest red gum (*E. tereticornis*) are common on the better drained sites. Ironbarks (including *E. fibrosa*) and spotted gum (*Corymbia maculata*) abound in many places, especially on drier rises or lateritic soils. The original ground cover consisted mainly of native grasses with scattered shrubs. Introduced grasses and the opportunistic native shrub blackthorn (*Bursaria spinosa*) dominate. Marshy depressions are dominated by cabbage gum (*E. amplifolia*), *Melaleuca decora* and other paperbarks with a marshy meadow of mainly native herbs. Swamp oak (*Casuarina glauca*) dominates the vegetation on the creek banks (Robinson 1991).

Photo: Vivien Jones

Young grey-headed flying-fox and mother

Photos: LPI air photography

Changes in vegetation at Cabramatta Creek Flying-fox Reserve from 1943 to 2007

The vegetation community in the reserve is a combination of River Flat Eucalypt Forest and Swamp Oak Floodplain Forest (Bewsher Consulting 2004; UBMC 1998a). The dominant native vegetation community at the reserve is Swamp Oak – Forest Red Gum – Cabbage Gum Forest (UBMC 1998b). Equally dominant at the site is the exotic large-leaved privet. The reserve contains four distinct vegetation strata. An emergent native canopy rises over an understorey of three lower strata dominated by weeds outcompeting native shrubs and ground covers.

The reserve contains significant features of tall open forest with mature swamp oak, forest red gum and blue box to 30 m with up to seven hollows per tree. Shrub cover is dense and confined to a riparian corridor. Areas away from the creek have been reduced to frequently mown pasture of exotic and native species. Cabramatta Creek, which surrounds the reserve, provides habitat for aquatic species (EEC 2005).

The reserve provides habitat for four species of mammals, the dominant one being the grey-headed flying fox. Also recorded at the site were 30 native and six introduced bird, four amphibian and five reptile species listed in the table below (UBMC 2003; EEC 2005).

| Stratum | Dominant plant species | Stratum height (m) | Stratum density |
|---|---|---|---|
| Canopy | *Casuarina glauca* | 10–20 | Moderate–dense |
| Sub-canopy | *Ligustrum lucidum** | 2–10 | Moderate |
| | *Acacia parramattensis* | | |
| | *Melaleuca stypheloides* | | |
| | *Melaleuca armillaris* | | |
| | *Casuarina glauca* | | |
| Shrub | *Bidens pilosa** | 0.5–1 | Sparse–moderate |
| | *Ligustrum sinense** | | |
| | *Sida rhombifolia** | | |
| | *Cestrum parqui* | | |
| Groundcover | *Tradescantia fluminensis** | 0–0.5 | Sparse–moderate |
| | *Ageratina adenophora** | | |
| | *Pennisteum clandestinum** | | |
| | *Bromus catharticus** | | |
| | *Anredera cordifolia** | | |
| | *Ipomaea indica** | | |
| | *Ehrhardta erecta** | | |
| | *Mircrolaena stipoides* var. *stipoides* | | |
| | *Cardiospermum grandiflorum** | | |
| | *Lomandra longifolia* | | |

* Exotic species
Source: UBMC (2003)


Photo: LPI air photography

Aerial photo of Cabramatta Creek – Warwick Farm area in 1943

## 1.6 Threats to grey-headed flying foxes

### 1.6.1 Clearing of native vegetation

Past and present clearing of vegetation has led to the listing of the grey-headed flying fox as a threatened species and the two vegetation associations in Cabramatta Creek Flying-fox Reserve which comprise its habitat as endangered ecological communities. Clearing bushland for urban development and agriculture poses a severe threat, particularly in the critical winter foraging habitat of coastal forests of NSW. This loss of foraging habitat increases the severity of food shortages leading to starvation of animals, spontaneous abortion and high infant mortality.

### 1.6.2 Disturbance at roosting sites

Flying foxes give birth in the spring (approximately October–November), with young flying foxes being dependent on their mother until they are able to fly out with adults of the camp in summer (January–February). Disturbance of grey-headed flying-fox camps during this time will likely result in the mothers dropping their young or, if the disturbance is during the last few weeks of pregnancy, spontaneously aborting.

### 1.6.3 Noise

Habitat needs to be restored with extreme care as sudden movements and loud noises can distburb the flying foxes. Mobile phones should be turned off while working on site. The use of chainsaws or other noisy power tools should be avoided when juvenile flying foxes are present. Disturbance may cause stress to the mothers who may drop their young. From September to February *absolutely no work* (loud or quiet) can be conducted in close proximity.

### 1.6.4 Unregulated shooting

Grey-headed flying foxes can damage some fruit crops. The extent of the damage can vary considerably from year to year, region to region, crop to crop, and even between orchards in the same district. Full crop netting is currently the only method proven to be completely effective in deterring grey-headed flying foxes (Appendix 3). Trials are underway into alternative deterrents, including the provision of native food sources (planting food trees). While killing any threatened species is undesirable and illegal, DECC may permit or license limited shooting of flying foxes to protect crops (*National Parks and Wildlife Act 1974*, section 120).

### 1.6.5 Electrocution on power lines

A serious threat to flying foxes is electrocution by powerlines from either collision or roosting. To prevent electrocution the local electricity distributor, Integral Energy, has introduced a cable bundling system on the main feeder power lines adjacent to the Cabramatta Creek Flying-fox Reserve colony which has been effective in reducing flying-fox deaths. However, some small low voltage powerlines installed in nearby streets still pose a threat.

**How you can help**

If you notice a flying fox caught on overhead power cables, look for a baby. If there is one, it will probably be difficult to see from the ground as the fur is the same colour as its mother's and it will be obscured by nestling under the mother's wing.

The most obvious feature will be a ping-pong ball sized blob of fuzzy orange fur. You may also hear the young one squeaking, or see the wing move as it tries to feed from the mother.

Call the local rescue organisation which will arrange for the baby to be removed from the power lines and taken to a qualified foster carer. All carers are fully vaccinated and covered by the rescue organisation's insurance policy.

In the Sydney Metro area call either Sydney Wildlife on 02 9413 4300 or WIRES on 1300 094 737.

### 1.6.6 Australian white ibis

Australian white ibis once inhabited the wetlands of inland Australia. However, due to severe drought conditions, they have migrated and adapted to the urban environment of the east coast of Australia, including the Cabramatta Creek Flying-fox Reserve. Due to a dramatic increase of Australian white ibis using the roost trees as nesting sites, and the continuous use of the site by grey-headed flying foxes, the vegetation was in steady decline which, if it had continued, would cause grey-headed flying foxes to seek a new camp in the region.

Canopy trees can contain as many as 10 white ibis nests. These are large nests which can damage the roost trees and force flying foxes away from the site. Grey-headed flying fox numbers have declined from 30,000 to 5,000 at the peak of white ibis habitation. Cabramatta Creek Flying-fox Reserve is not big enough for the two species to cohabit. Mid-storey shrub stratum has been lost as white ibis faeces contain a high phosphorus content which burns the leaves of the mid-storey vegetation, reducing its density by 50%. The loss of the mid-storey increased the temperature of the microclimate, which amplified the incidence of heat stress felt by the flying foxes.

Photo: B Walters/DECC

Australian white ibis at Cabramatta Creek Flying-fox Reserve

### 1.6.7 Barbed wire fencing

Where possible land managers should choose an alternative to barbed wire fencing in areas adjacent to and frequented by grey-headed flying foxes which can be killed when flying into the barbed wire or become trapped and die from injury or stress. Small gauge mesh fencing, shade cloth and other forms of screening provide suitable options.

# 2 Guidelines for bush managers and regenerators

Bush regeneration of grey-headed flying foxes habitat usually involves the control of weeds; management of access, fire, fauna habitat and Australian white ibis; and community awareness and monitoring.

Removal of weeds by hand favours the regeneration of native ground covers and shrubs as soil disturbance is minimised. Management of access to a site by installing barriers helps to prevent the dumping of rubbish and use of unregulated tracks.

Pile burning helps to maintain the structural integrity of endangered ecological communities and controls weeds. Results will be systematically monitored and compared to other bushland sites.

Strategies to reduce degradation by Australian white ibis and other animals need to be implemented.

The local community and visitors need to be encouraged to sustain ecological communities and regenerate bushland remnants – this is an important focus of bushland managers and regenerators.

## 2.1 Australian bat lyssavirus

Australian bat lyssavirus (ABL) was first identified in 1996, and has caused death in the only two known cases where the virus has been contracted by humans. The virus has been found in only two types of flying foxes and, although only a very small proportion of flying foxes have been found to carry the disease, for safety reasons all Australian species must be assumed to have the potential to transmit ABL.

ABL can be transmitted to humans via bites or possibly from scratches as these provide direct access of the virus in the saliva to exposed tissue. At the time of writing nobody in Australia has contracted the virus from a scratch. Blood and excrement from flying foxes is not regarded as a potential risk, although it is best to avoid contact with these substances. Suitable clothing includes a hat, long-sleeved shirt and sunglasses. Do not look up with your mouth open (CCFFC 2002).

The Department of Health has guidelines on how to avoid contracting ABL. If bitten by a flying fox clean and sterilise the wound thoroughly (at least 10 minutes under running water) then seek medical advice. First aid kits should contain soap and antiseptic.

All bushland regenerators and volunteers working in and around a flying-fox camp must understand the causes, symptoms and first aid treatment of ABL. Immunisation of those who work in camps and who work directly with flying foxes is recommended.

Keep a copy of the Department of Health ABL guidelines in the first aid kit which should be taken to a medical practitioner. These guidelines are available from www.health.nsw.gov.au/factsheets/infectious/rabiesbatinfection.html. For further information, contact the NSW Health Department on 02 9391 9000 or at www.health.nsw.gov.au.

## 2.2 Bushland regeneration

In 1995, Cabramatta Creek Flying-fox Reserve was severely infested with weeds. A dense subcanopy of broad-leaved privet (*Ligustrum lucidum*) dominated the site; canopy trees were blanketed with exotic vines such as Madeira vine (*Anredera cordifolia*) and balloon vine (*Cardiospermum grandiflorum*). Other prominent weeds included bridal creeper (*Asparagus asparagoides*), blackberry (*Rubus fruticosus*) and trad (*Tradescantia fluminensis*) carpeting the ground to a thickness of 30 cm.

Due to the dominance of weeds, Sydney Coastal River Flat vegetation could not regenerate. The weeds also prevented the germination of swamp oak that the flying foxes depend on as roost trees. As the mature casuarinas were under constant stress due to the continued use by the flying foxes, it appeared they would eventually die out leaving the site completely dominated by weeds.

Only work small manageable areas, leaving stands of 'caretaker' weeds to maintain habitat. Before beginning regeneration work observe which weeds flying foxes favour. This ensures that the correct weeds are left. As animal species also feed on smaller organisms that are found in habitat provided by logs and leaf litter, do not remove or disturb fallen branches.

### 2.2.1 Planning and site assessment

The restoration and management of Cabramatta Creek Flying-fox Reserve is guided by a plan of management which sets out the following objectives:

- site assessment, including an assessment of resilience and threatening processes
- strategies for ecological restoration
- strategies for community awareness
- incorporation of legislative requirements
- site monitoring and evaluation of restoration methods.

**Neighbours**

To keep flying foxes away from nearby urban areas, roost trees have not been planted along the edges of Cabramatta Creek Flying-fox Reserve; instead, dense mid-storey shrubs were planted to discourage flying foxes and to provide a sound barrier to reduce noise levels and minimise odour.

### 2.2.2 Weed control

A common oversight is removing canopy weeds without considering the effect that increased sunlight levels and warmth may have on the vegetation below. It is best practice to remove weed species in the ground layer first to encourage regeneration of native species.

Weed removal causes soil disturbance which promotes germination of both native and weed species. Follow-up weeding must therefore be undertaken to prevent weeds out competing native seedlings. After initial weeding, an area is to be viewed as sensitive and should not be worked heavily for two to three months. Native seedlings must be given time to establish, and while germinating weeds may shield native seedlings from harsh environmental conditions, it is important to remove them before they set seed.

As regenerating natives become established, the need for maintenance lessens. However, as Cabramatta Creek Flying-fox Reserve is surrounded by development and modified landscapes, invasion of weeds is ongoing. In particular, birds spread weeds through their faecal material.

Small sections along the creek-line at the site's perimeter were treated as the area was furthest from the flying-fox colony, and there was a large number of native canopy species, which meant that weeding would encourage native species to regenerate.

A mosaic approach was taken for primary weed removal. This allows the flying foxes to move between areas during regeneration. Tunnels can be introduced into the vegetation to allow access through the site with minimal disturbance to both the site and the flying foxes.

Primary works involved brush-cutting large woody weeds such as broad-leaved privet down to ground level and then applying a small amount of herbicide to the stumps. If the weed was too large to be cut down, a hole was drilled into the trunk and filled with herbicide. Dead woody weeds were left in place to provide habitat and to reduce the risk of soil erosion as well as the cost of removal. Due to the close proximity to Cabramatta Creek, herbicide use was kept to a minimum.

Trad was raked up and piled on weed mats or tarpaulins. The piles were moved to a sunny location, tipped onto the bare ground and covered in black plastic. This method takes advantage of the plastic being heated during the day, killing the weeds underneath, allowing the resulting mulch to break down into the soil. This process failed when an unscheduled flood washed away the plastic and redistributed the weeds across the site. Consequentially, weeds were removed to the local waste disposal centre.

Raking back the trad from underneath the native canopy assisted in natural revegetation by increasing the resprouting of casuarina and eucalyptus seeds. This strategy is particularly effective for these species as they do not have effective long-range seed dispersal mechanisms (Benson and Howell 1990).

### 2.2.3 Weeds as habitat

Flying foxes avoid areas that have been cleared, so there has been no overclearing of weeds in Cabramatta Creek Flying-fox Reserve. Allow time for native trees and shrubs to replace the weeds that have been removed, and always search exotic plants for bird or ringtail possum nests before removing them.

Large-leaved privet is an important roost and shade tree for flying foxes and plays a vital role for juveniles to survive days of excessive heat. Removing the privet would have a disastrous effect, far worse than leaving the site to degrade. Large-leaved privet will remain on site for as long as it takes the native vegetation to regenerate.

### 2.2.4 Revegetation

Revegetation must not oversimplify an ecosystem. All-layer planting, where a range of canopy, mid-storey and ground layer species are planted randomly, provides cover and plants with a diversity of root depths. The regenerating vegetation is a close approximation to the original bushland.

Planting tube stock has the advantage that seedlings already have a root network able to absorb moisture and anchor the soil. This stabilises the soil and was used at Cabramatta Creek Flying-fox Reserve. Tree guards were installed to protect tube stock from weed competition and extremes of weather.

Plantings focused on canopy species, primarily swamp oak, and a mid-storey of nitrogen-fixing wattles to condition the soil and enhance the microclimate. Swamp oak, which occurs naturally in Cabramatta Creek Flying-fox Reserve, is a primary roost tree as the branches bend rather than break under the weight of the flying foxes.

Ensuring the success of both the canopy and mid-storey layers was important for long-term rehabilitation of the site, as it takes decades before the tube stock are mature enough to support the weight of the flying foxes. The establishment of the canopy also helps to suppress the growth of weeds in the lower strata and creates better soil conditions for the growth of native grasses and ground covers.

> **Planting tip:** Before planting tube stock fill the hole with water and allow it to drain. This saturates the soil and is useful when plantings cannot be regularly watered.

### 2.2.5 Seed collection

Because of the depleted seed bank of Cabramatta Creek Flying-fox Reserve, seeds of local provenance were used to establish the plant community. The seeds were grown to tube stock in Fairfield City Council Nursery. Under the TSC Act, a licence is required to collect seed from an endangered ecological community.

As regenerated areas require ongoing monitoring and management, those involved in the restoration of Cabramatta Creek Flying-fox Reserve did not attempt to clear more than they were able to maintain. Despite the success of primary control measures, weeds require ongoing removal. To ensure that no native seedlings were removed, a professional bush regenerator trained volunteers in plant identification and weed removal.

### 2.2.6 The seed bank

The long-term survival of bushland remnants is dependent on an intact and viable seed bank. Even when remnants appear weedy and degraded, the seed bank can be the key to regeneration (Lesak 2000). The regeneration of species in the seed bank would be likely if the soil profile remains relatively undisturbed. Weed removal and fire can stimulate the seed bank and help remnant bushland to recover. At some sites other triggers, such as smoke water and brush matting, can be effective. Allowing an area to recover by natural regeneration for as long as is practicable is preferable.

When the seed bank is depleted and the natural vegetative community cannot regenerate, planting helps recover some of what has been lost.

Mulching native vegetation can prevent seeds germinating and can introduce undesirable fungal species.

### 2.2.7 Herbicides

The use of herbicides is recognised as a necessary tool in the control of weeds. Spot spraying is to be considered only after careful preparation of the area, and should be restricted to the edge of remnants. Herbicide use in remnants is to be restricted to 'cut and paint' or 'scrape and paint' methods. This is particularly important in communities that are situated on a slope, where hand pulling weeds will result in disturbance to sandy soils which are highly susceptible to erosion. Generally, hand weeding is recommended where appropriate.

### 2.2.8 Buffers and adjoining vegetation

Bushland on the edge of Cabramatta Creek Flying-fox Reserve acts as a buffer, minimising the detrimental edge effects of desiccation, runoff, rubbish dumping and weed encroachment. Buffer areas also improve ecological function as corridors used by pollinating species, such as birds and insects. The size of the buffer, therefore, should be as large as possible, but where the buffer is degraded, reconstruction through revegetation may be appropriate where there is little or no seed bank of native species. Fairfield Council has replanted locally sourced native species, which has aided in the formation of bushland corridors linking remnants to other bushland areas.

## 2.3 Phytophthora cinnamomi

*Phytophthora cinnamomi* is a soil-borne plant pathogen that can survive in soil for long periods. It causes dieback in a variety of plants by rotting their root systems. River Flat Eucalypt Forest and Swamp Oak Floodplain Forest remnants are believed to be susceptible to dieback caused by *P. cinnamomi*. Preventing and limiting the spread of *P. cinnamomi* by the appropriate sanitation procedures is the most effective means of control.

Boots, vehicle tyres, tools and machinery should be regularly cleaned of any soil adhering to them and drenched in a 1% solution of bleach. When planting, disinfect tools between plantings.

*P. cinnamomi* can persist in dead organic tissue for many years. Dead roots and any above ground pruned material must be disposed of carefully. This is especially important if the site management practice is to remove weeds off site. Never woodchip vegetation suspected of being infected by *P. cinnamomi*.

## 2.4 Fire management

Fire can have a positive effect on vegetation communities as germination of some plants requires a high temperature provided by fire (DEC 2005). As Sydney's suburbs have expanded, bushfires have been reduced or eliminated. Fire is now seen as necessary for regeneration and ecosystem health (Buchanan 1989; Thomas 1994).

Many bushland remnants are dependent on fire to maintain diversity. Without fire, some native plants such as *Pittosporum undulatum* or *Leptospermum laevigatum* will eventually dominate the vegetation and block light to the understorey which eventually decreases diversity. Without fire, the seed bank of some native species, such as *Banksia serrata*, will diminish.

A lack of fire, or a fire that is too intense, can result in the dominance of weed species such as privet, lantana and weed grasses (Buchanan 1989).

Prescribed burning creates conditions favourable for seed germination. An appropriate fire regime will:

- increase the amount of sunlight reaching the soil
- increase the diversity of species in communities that require fire for regeneration
- encourage new growth of microbial flora (fungi) that aids in the germination of seedlings
- release nutrients such as nitrogen and phosphorus into the soil which aid in plant growth and vigour.

There have been no fires in the Cabramatta area for at least 20 years (RFS 2006). River Flat Eucalypt Forest has evolved in response to regular burning, and may require fire to increase plant diversity and recruitment.

An appropriate fire regime for River Flat Eucalypt Forest would be a high intensity fire during August and January every 10–30 years (R. Lembit 2007, pers. comm.). This would ideally be undertaken in August to avoid the flying-fox birthing season, and to ensure that only a small number of animals are present in Cabramatta Creek Flying-fox Reserve.

Some areas have been decimated by Australian white ibis and these could be areas for prescription burning to assist in reduction of the ibis population by temporarily changing the structure of their habitat.

To maintain the ecological health of bushland remnants in Cabramatta Creek Flying-fox Reserve, prescribed burning of small areas to trigger native regeneration and to control weeds has been introduced. Small piles of cleared, dry vegetation are systematically burnt under controlled conditions. Both the treatment and the post-fire regeneration results are closely monitored.

### 2.4.1 Seasonal and mosaic fires

Applying fire which varies in frequency, duration, intensity and seasonality will maximise biodiversity (Buchanan 1989; Bradstock et al. 1995). For example, fire in mild conditions in late summer and autumn is favourable to the survival of seedlings of *Banksia ericifolia* and *B. serrata* (Bradstock and Bedward 1992). Many species set seed in spring and provide food sources for native animals.

The benefits of mosaic burns are:

- structural diversity in the regenerating flora when adjacent areas are burnt every 2–5 years
- designated sections of importance, which are not burnt, such as fauna habitat and recently burnt areas
- the provision of fauna habitat and adequate food supply by allowing some areas to remain unburnt
- maintaining burnt areas to a suitable size for bushland regenerators to effectively maintain.

### 2.4.2 Inappropriate fire regimes

Inappropriate fire regimes include burning too frequently, which can result in the loss of many native species as some plants have insufficient time to mature and set seed. The desired interval between fires for Cabramatta Creek Flying-fox Reserve is 10–15 years. There should be a fire at least once every 30 years (DEC 2005).

Other inappropriate fire regimes include:

- burning an area that is too large to be maintained
- not ensuring sufficient adjoining habitat is left unburnt providing adequate shelter for fauna
- failing to burn the area to an ash bed so that weeds proliferate in unburnt areas.

### 2.4.3 Managing fire

Protection of life and property is always the primary consideration in an urban setting. Wherever possible, fire suppression strategies should be carried out with minimal disturbance to the vegetation, including:

- no construction of additional fire trails, tracks or widening of existing tracks
- no use of wetting agents or chemical retardants, as these may impact on soil condition.

### 2.4.4 Site preparation and management

Prescribed burning aims to create a ground fire that reduces the burnt area to an ash bed. Low intensity burns are not as effective as weed species are likely to survive in partially burnt or unburnt sections and may outcompete native plants.

Before burning, woody weeds should be cut and painted, with the removed weeds placed into piles. Weed piles are spaced throughout the prescribed burn area and left to dry. If there is an extended period of time after the primary weed clearing and before the burn can be undertaken, weed monitoring and maintenance where required should take place in the prescribed burn zone. Follow-up maintenance keeps weeds under control until the burn.

During the burn, weed piles enable the fire to burn hotter and promote the germination of native species. It is important to construct piles at different sizes and, if possible, allow the fire to burn in between the piles where the fire burns at a lower heat. This heat variability encourages a diverse range of responses from the seed bank.

It is important that weed piles are not more than one metre high, as this may result in a fire that burns too intensely and may sterilise the soil seed bank under the centre of the pile. The pile should be long rather than high; this will disperse the heat (DEC 2005). Ensure weed piles are not under powerlines, close to fences, at the base of trees or under a low canopy.

A potential danger with small patch burns is that the areas can be potentially reburnt in unplanned, deliberately lit or wild fires. This can lead to decline or loss of plant species and stress to fauna, and the potential for wildfires or unplanned fires should be determined.

### 2.4.5 Post-fire maintenance and monitoring

Fire can stimulate the germination of weeds. Trad nodules can regenerate and outcompete native plants, rendering the prescribed burn futile (AHC 2003). The following recommendations will reduce the risk of weeds dominating the site.

- Soil disturbance caused by weed removal has the potential to affect regenerating native seedlings; seedlings should become established before removing weeds before they set seed.
- Post-fire maintenance requires those with plant identification skills to target weed seedlings without harming fragile regenerating native plants.
- If post-fire maintenance is not possible, the prescribed burn should not go ahead; seedlings of native species must be able to grow to maturity and set seed, otherwise the seed bank will become depleted.
- Monitoring the impacts of all fires, whether planned or unplanned, allows land managers to evaluate and modify fire management practices.

### 2.4.6 Fire checklist

Following the completion of an environmental assessment for the proposed burn area, relevant authorisations and permits must be obtained from local council, the Rural Fire Service and, if necessary, DECC. Generally in built-up areas in the Sydney Metropolitan area a section 132c licence and a certificate for open burning are required from DECC.

A pre-fire fauna search must be carried out. The fire plan may need to be modified to accommodate species requirements; for example, an area may not be burnt if it contains currently used birds' nests or a patch of juvenile native plants which would be destroyed by the fire.

Notify neighbours well in advance and again 24–48 hours before the proposed burn.

Have adequate fire control measures in place on the day, including suitable fire appliances with adequate hoses and traffic control measures, and resources to deal with unplanned contingencies.

Ensure the weather is appropriate for the burn; this includes minimising smoke drift towards residences, hospitals and schools.

Record the time of year, location, size and intensity of the fire, weather conditions on the day of the burn and the response of vegetation after the fire.

### 2.4.7 Fire management summary

After a prolonged period (greater than 15 years) without fire or similar disturbance, the floristic composition and vegetation structure of the community becomes simplified. Fire management strategies in flying-fox habitat needs to take account of the following:

- A high fire frequency will reduce species diversity and must be avoided.
- Weed treatment, both pre-fire and post-fire, is essential.
- Fire history records and maps, within and outside reserves, need to be accurate, detailed and regularly updated.
- Summer and autumn fires are more likely to be favourable for successful regeneration of banksia species than winter and spring burns.
- Fire responses of many flora and fauna according to seasonality are not well known although this information is increasing with further research.
- No construction of additional fire trails or tracks or the widening of existing tracks should be undertaken in bushland remnants.
- Wetting agents or chemical retardants should not be used in remnants, especially near streamlines.

## 2.5 Fauna management

Animals are an essential component of ecosystem functioning. Some birds eat insects that feed on the trees and cause dieback (Collett 2001). Weeds can provide habitat and foraging resources for native birds and other fauna. Careful consideration must be taken during weed removal with regard to retaining habitat for native fauna.

Grey-headed flying foxes are migratory, with their camps separated but interconnected ( Web and Tidemann 1996). Translocation may be ineffective, due to more flying foxes replacing those that have been displaced.

Radio-tracking has revealed that individual flying foxes can travel up to 978 km during an 18-month period (Spencer et al. 1991). Unlike migratory birds, grey-headed flying foxes do not migrate according to predictable patterns, as they respond to the flowering and fruiting of native plants (Webb and Tidemann 1996).

### 2.5.1 Flying-fox camps

Grey-headed flying foxes roost in communal camps which are usually located in patches of dense vegetation typically among tall (>10 metres high) trees with a dense understorey where the flying foxes can retreat during hot weather. Camps provide shelter and focal points for social interactions and some also act as maternity camps where annual breeding and rearing of young flying foxes takes place.

Some camps are used on an occasional basis, depending on flowering and fruiting of local food sources, while other camps are inhabited by a core of flying foxes all year round. Since 1800 many of the areas used have been cleared or heavily disturbed. The degradation or destruction of grey-headed flying-fox camps is listed as a threatening process under the TSC Act and can affect their population, which may then search for new camps.

Photo: Kate Cabezas, Fairfield City Council

Treating a severely dehydrated flying fox

### 2.5.2 Heat stress

Heat stress when temperatures exceed 44°C or when the flying foxes panic can disrupt maternity camps causing mothers to drop their young (Eby 1995; McIlwee and Martin 2002).

Each summer Cabramatta Creek Flying-fox Committee and wildlife care organisations, such as WIRES, help flying foxes cope with heat stress. Approximately 4,000 deaths have been recorded on a day when temperatures exceeded 44°C.

A high number of dead animals results in an objectionable odour as their bodies decay (CCFFC 2002); with the implementation of the following practices, recorded daily fatalities have reduced to around 400.

- Water, either collected on site from rain or brought in, is sprayed in a fine mist above the flying foxes simulating a light rain shower, while avoiding spraying the flying foxes directly and causing them further stress. The water is kept at a steady height allowing the flying foxes to fly through the mist to cool off. The flying foxes can lick the water off the mid-storey vegetation and their fur to rehydrate.
- Flying foxes can fall to the ground on excessively hot days and require first aid. Water-based rehydration fluids can be given orally by syringe. First aid must be administered by trained wildlife carers who have been immunised against ABL.
- Flying foxes suffering from heat stress need to have their core temperature lowered by slow immersion in water. Only trained wildlife carers who are immunised against ABL should handle flying foxes in this way.

### 2.5.3 Restoring vegetation damaged by Australian white ibis

Australian white ibis have migrated to coastal areas in response to severe drought and have adapted to the urban environment, reaching pest concentrations at many locations in the Sydney region, including the Cabramatta Creek Flying-fox Reserve.

The mid-storey shrub stratum in the reserve has decreased to 50% of its original density since the drought in 1994. It is hypothesised that the occupation of white ibis exacerbated vegetation damage, contributing to the decline (Tidemann 2002). White ibis faeces have high phosphorus content which has contributed to the defoliation of the vegetation. The loss of mid-storey density is thought to be the cause of the death of 500–3000 grey-headed flying foxes in the reserve each day when temperatures exceed 44ºC.

Management of Australian white ibis in the past has included trapping and nest and egg destruction with differing degrees of success. The birds, while being temporarily disturbed, have not stopped reusing a site to breed.

Coating ibis eggs with vegetable oil prevents chicks from hatching. As the eggs appear intact, the female ibis defer laying another clutch and move elsewhere.

The following strategies can be used if ibises return:

- coating of eggs with canola oil to prevent hatching and decrease breeding success
- destruction or disturbance of ibis nests in the reserves
- reduction of food sources in the local foraging range, including Warwick Farm and the UR-3R waste facility at Horsley Park
- support for Bankstown City Council in the Australian white ibis sanctuary at Lake Girraween
- restoration of habitat for grey-headed flying foxes that has been damaged.

To reduce the risk of impact on grey-headed flying foxes, pile burns will be implemented in the centre of the Cabramatta Creek Flying-fox Reserve where canopy is not present to assist planting additional roost trees.

### 2.5.4 Introduced animals

Cats and foxes prey on small mammals and birds, while rabbits graze on vegetation. The main strategies to mitigate these threats are neighbourhood liaison with, and education by, council staff and the Cabramatta Creek Flying-fox Committee.

### 2.5.5 The habitat provided by rubbish

Old pipes, tiles, car bodies and pieces of tin and other metals can be left temporarily as they provide habitat (Ondinea 1998). It may be advantageous to leave rubbish and work towards gradual removal or removal by natural processes, allowing time for fauna to adapt.

## 2.6 Community access

While the local community has a connection with surrounding bushland, the small size of bushland remnants increases the susceptibility of degrading forces such as trespass, grazing by feral animals, track development (including bike tracks), rubbish dumping and weed encroachment. To minimise these effects a number of barrier techniques can be used.

### 2.6.1 Weeds as barriers

Where practical, weeds such as broad-leaved privet and blackberry can be left in dense stands along the edge of the remnant. Weed barriers can prevent further weed encroachment and protect regeneration areas by reducing unnecessary access and rubbish dumping.

### 2.6.2 Sediment fences

Sediment fences help prevent the spread of weeds, such as invasive perennial grasses. They significantly reduce maintenance of the interface between bushland areas and the urban fringe.

### 2.6.3 Earth mounds

To reduce illegal rubbish dumping into Cabramatta Creek Flying-fox Reserve, a 1.5 m x 20 m earth mound was constructed along the roadside and planted with plants of local provenance (DEC 2005).

## 2.7 Community awareness

Educating the community on the importance of preserving grey-headed flying foxes is an effective way of ensuring the long-term conservation of the species. Their role as pollinators of eucalypts and dispersers of rainforest tree seeds should be emphasised.

Presenting a hand-reared grey-headed flying fox at schools and field days, while explaining their ecology, is one of the most effective methods of gaining public appreciation of the flying foxes. Fairfield City Council has a life-like replica of a flying fox which children can hold.

An effective strategy employed by Fairfield City Council since 1995 to answer concerns and increase knowledge about flying foxes is to provide people with information in the form of fact sheets, newsletters and websites, and organising public meetings to address community concerns and provide positive publicity about flying foxes.

Fairfield City Council has recently installed a viewing platform with interpretive signage at Cabramatta Creek Flying-fox Reserve. The platform has a water tank to mist spray the bats on very hot days.

### 2.7.1 Volunteers

The work of volunteers in the restoration of bushland in Sydney has long been acknowledged as a significant and valuable contribution. Many councils and land managers, including DECC, rely on volunteers to undertake bush regeneration and public education in and around reserves.

The work of volunteers must not be taken for granted, nor solely relied upon, for restoration in endangered ecological communities. These areas are important and worth funding the employment of professional bush regenerators to carry out restoration and to assist volunteers and community groups.

Photo: Fairfield City Council

Viewing platform at Cabramatta Creek Flying-fox Reserve

### 2.7.2 Research

Cabramatta Creek Flying-fox Reserve has been the focus of several research projects, including study of the biology, behaviour and microclimate requirements of grey-headed flying foxes.

The science of the restoration of the Cumberland Plain endangered ecological community is a recent development, with a relatively small body of literature compared to the well-documented vegetation communities such as those on Hawkesbury sandstone (DEC 2005). The biology and management of grey-headed flying foxes is a relatively new area of interest. It is important that further research be undertaken so that the flying foxes and their habitat can be managed effectively.

Flying foxes in Cabramatta Creek Flying-fox Reserve are counted every year by the Flying-fox Information and Conservation and the Threatened Species Networks. This is part of an annual count across eastern Australia to ascertain flying-fox populations and has provided the basis of their listing under the TSC Act.

**Food for flying foxes**

Encourage flying foxes to your backyard by planting native food trees; this is a strategy which may assist in removing flying foxes from the threatened species list.

Planting blue gums, blackbutts, turpentines, ironbarks, bloodwoods and angophoras in backyards and on council land will not only provide residents with low maintenance native gardens but also the added delight of increasing the frequency of visits from native birds, butterflies and flying foxes.

## 2.8 Summary of management strategies

Management strategies to restore and expand the habitat of grey-headed flying foxes include:

- support for the Cabramatta Creek Flying-fox Committee, which has been responsible for the volunteer section of the habitat restoration project and community education program
- bush regeneration since 1995 that focuses on restoring vegetation using best practice bush regeneration and weed control techniques
- an extensive seed collection and planting program within Cabramatta Creek Flying-fox Reserve and in adjacent Liverpool Council land, in order to extend grey-headed flying-fox habitat
- response to heat exposure and heat stress management of grey-headed flying foxes when temperatures exceed 44°C

Photo: Fairfield City Council

Volunteer working on bush regeneration

- management of Australian white ibis to minimise the destruction of camp trees
- community education
- use of weeds to provide shade cover, roosting sites and protection from predators.

Because of the implementation of these best practices by bush regenerators and land managers, grey-headed flying foxes continue to occupy Cabramatta Creek Flying-fox Reserve in large numbers.

### 2.8.1 Reporting sick and injured flying foxes

If you find a sick or injured flying fox *do not touch it*. Call WIRES on1300 094 737 or Sydney Metropolitan Wildlife Service (24 hours) on 02 9413 4300.

# 3 Licensing issues

It is illegal to harm native fauna under section 100 of the *National Parks and Wildlife Act 1974* (NPW Act).

The destruction of grey-headed flying-fox camps is listed as a threatening process under the TSC Act (Schedule 2, Part 1).

While the killing of any threatened species is undesirable and illegal, DECC may permit or license limited shooting of flying foxes to protect crops (NPW Act, section 120).

Bush regeneration, weed control, clearing for fire breaks, and almost any activity within a bushland remnant requires either a section 91 certificate of approval (TSC Act), or section 132c licence (NPW Act) from DECC. Generally a section 91 licence is required for actions that are destructive, while a section 132c licence is required for scientific or conservation purposes. The section 91 certificate application should be submitted to the Metropolitan Operations Branch of DECC and a section 132c application to the Wildlife Licensing Section of DECC.

Where prescription burning, including pile burning, is being considered on private or public land (with the exception of reserves managed by the NSW NPWS) within the metropolitan area, an open burning approval certificate must be obtained together with one of the above certificates from the Metropolitan Operations Branch of DECC's Biodiversity Conservation Section.

More information on licences, agreements, regulations and policies can be found at www.environment.nsw.gov.au/threatenedspecies/licagreeregspols.htm, and on the TSC Act www.environment.nsw.gov.au/legislation/legislation.htm.

Where burning is to occur on NPWS managed lands, the normal environmental assessment and certification procedures apply in accordance with the reserve fire management strategy and plan of management guidelines. Lodgement is with the relevant certifying authority (*Rural Fire Service Act 1994*), BRIMS tool and notifications to the applicable local fire district authorities.

# Appendix 1: Volunteering

You can help the recovery of the grey-headed flying fox by contacting your local council or one of the organisations listed below.

Cabramatta Creek Flying-fox Committee
PO Box 430, Bonnyrigg NSW 2177
www.fairfieldcity.nsw.gov.au
(02) 9725 0222

Ku-ring-gai Bat Conservation Society Inc.
PO Box 607, Gordon NSW 2072
www.sydneybats.org.au

The Australasian Bat Society Inc
PO Box 481, Lindfield NSW 2070
www.ausbats.org.au

# Appendix 2: Plant species in the diet of flying foxes in northern NSW

**Native fruits**

| | |
|---|---|
| *Acmena hemilampra* | Broad-leaved lilly pilly |
| *Acmena ingens* | Red apple |
| *Acmena smithii* | Lilly pilly |
| *Alphitonia excelsa* | Red ash |
| *Archontophoenix cunninghamiana* | Bangalow palm |
| *Avicennia marina* | Grey mangrove |
| *Cissus hypogaluca* | Five-leaf water vine |
| *Davidsonia* spp. | Davidson's plum |
| *Dendrocnide excelsa* | Giant stinging tree |
| *Dendrocnide photinophylla* | Shining-leaved stinging tree |
| *Diospyros pentamera* | Myrtle ebony |
| *Diploglottis australis* | Native tamarind |
| *Ehretia acuminata* | Koda |
| *Elaeocarpus grandis* | Blue fig |
| *Elaeocarpus obovatus* | Hard quandong |
| *Elaeocarpus reticulatus* | Blueberry ash |
| Ficus coronata | Creek sandpaper fig |
| *Ficus fraseri* | Sandpaper fig |
| *Ficus macrophylla* | Moreton bay fig |
| *Ficus obliqua* | Small-leaved fig |
| *Ficus rubiginosa* | Rusty fig |
| *Ficus superba* | Deciduous fig |

| | |
|---|---|
| *Ficus virens* | White fig |
| *Ficus watkinsiana* | Strangler fig |
| *Hedycarya angustifolia* | Native mulberry |
| *Livistona australis* | Cabbage palm |
| *Maclura cochinchinensis* | Cockspur thorn |
| *Mallotus discolor* | White kamala |
| *Melia azedarach* | White cedar |
| *Melodinus australis* | Southern melodinus |
| *Morinda jasminoides* | Morinda |
| *Notothixos cornifolius* | Kurrajong mistletoe |
| *Passiflora* spp. | Native passionfruit |
| *Pennantia cunninghamii* | Brown beech |
| *Pittosporum undulatum* | Sweet pittosporum |
| *Planchonella australis* | Black apple |
| *Podocarpus elatus* | Plum pine |
| *Polyosma cunninghamii* | Featherwood |
| *Rauwenhoffia leichardtii* | Zig zag vine |
| *Rhodamnia argentea* | Malletwood |
| *Schizomeria ovata* | Crabapple |
| *Syzygium australe* | Brush cherry |
| *Syzygium corynanthum* | Sour cherry |
| *Syzygium crebrinerve* | Purple cherry |
| *Syzygium luehmanii* | Riberry |
| *Syzygium oleosum blue* | Lilly pilly |

**Native blossoms**

| | |
|---|---|
| *Angophora costata* | Smooth-barked apple |
| *A. floribunda* | Rough-barked apple |
| *Banksia integrifolia* | Coast banksia |
| *B. serrata* | Old man banksia |
| *Castanospermum australe* | Black bean |
| *Corymbia gummifera* | Red bloodwood |
| *C. henryi* | Large-leaved spotted gum |
| *C. intermedia* | Pink bloodwood |
| *C. maculata* | South spotted gum |
| *C. trachyphloia* | White bloodwood |
| *C. variegata* | North spotted gum |
| *Eucalyptus acmenoides* | White mahogany |
| *E. albens* | White box |
| *E. amplifolia* | Cabbage gum |
| *E. andrewsii* | New england blackbutt |
| *E. bancroftii* | Orange gum |
| *E. campanulata* | New england blackbutt |
| *E. crebra* | Narrow-leaved ironbark |
| *E. fibrosa* | Broad-leaved ironbark |
| *E. grandis* | Flooded gum |
| *E. macrorhyncha* | Red stringybark |
| *E. melliodora* | Yellow box |
| *E. moluccana* | Grey box |

| | |
|---|---|
| *E. paniculata* | Grey ironbark |
| *E. pilularis* | Blackbutt |
| *E. planchoniana* | Bastard tallowwood |
| *E. propinqua* | Small-fruited grey gum |
| *E. punctata* | Large-fruited grey gum |
| *E. pyrocarpa* | Large-fruited blackbutt |
| *E. resinifera* | Red mahogany |
| *E. robusta* | Swamp mahogany |
| *E. rummeryi* | Steel box |
| *E. saligna* | Sydney blue gum |
| *E. seeana* | Narrow-leaved red gum |
| *E. siderophloia* | Grey ironbark |
| *E. sideroxylon* | Mugga ironbark |
| *E. tereticornis* | Forest red gum |
| *E. tetrapleura* | Square-fruited ironbark |
| *Grevillia robusta* | Silky oak |
| *Lophostemon confertus* | Brush box |
| *Melaleuca quinquenervia* | Broad-leaved tea tree |
| *Syncarpia glomulifera* | Turpentine |

**Leaves**

| | |
|---|---|
| *Avicennia marina* | Grey mangrove |
| *Populus* spp. | Poplar |

**Exotic fruits**

| | |
|---|---|
| *Annona* spp. | Custard apple |
| *Carica papaya* | Papaya |
| *Celtis sinensis* | Chinese elm |
| *Cinnamomum camphora* | Camphor laurel |
| *Citris reticulata* | Mandarin |
| *Citris* spp. | Orange |
| *Diospyros* spp. | Persimmon |
| *Ligustrum lucidum* | Large-leaved privet |
| *L. sinense* | Small-leaved privet |
| *Litchi chinensis* | Lychee |
| *Malus* spp. | Apple |
| *Mangifera indica* | Mango |
| *Morus nigra* | Mulberry |
| *Musa* spp. | Banana |
| *Passiflora* spp. | Passionfruit |
| *Prunus persica* | Peach |
| *P. persica* var. *nectarina* | Nectarine |
| *Prunus* spp. | Plum |
| *Psidium guajava* | Guava |
| *Solanum mauritianum* | Wild tobacco |
| *Syagrus romanzoffiana* | Cocos palm |
| *Vitis* spp. | Grape |

# Appendix 3: Netting of fruit trees

An effective way to keep flying foxes, birds and possums off fruit is a net over the fruit tree. Netting installation must be in accordance with guidelines developed by the NSW National Parks and Wildlife Service to prevent unnecessary death or injury to wildlife.

The following are recommended when netting.

- Never use thin nylon (monofilament) netting material as this can cause serious injuries.
- Use durable knitted netting 40 mm diameter or smaller.
- Use white netting so wildlife are able to see and avoid it.
- Never throw netting loosely over trees as this can lead to entanglement, injury or death to wildlife.
- Always ensure netting is stretched taut and held away from the tree.
- Regularly check netting that it is secure and that no wildlife has become entangled.
- An alternative is to drape shade cloth over fruit.

These articles give more details on netting to both protect fruit and avoid injury to wildlife

## The cost of entanglement

Entanglement in backyard netting occurs when trees are fruiting, mostly in spring and summer months, with most fatal injuries being caused by thin, dark-coloured nylon netting draped loosely over trees. Netting of backyard fruit trees most commonly takes place in urban areas and is reflected in the prevalence of entangled animals in and near towns and cities. Estimates from the records of wildlife rescue groups indicate approximately 50% of entangled animals die and the remaining 50% require care (often long-term) before release.

### Death trap for threatened species

Flying-foxes are frequently entangled in backyard fruit tree netting. Of the four species known to be affected in NSW and Queensland, three are listed as threatened (i.e. at risk of extinction). Spectacled flying-foxes (found in Queensland) are endangered under State and Commonwealth legislation; black flying-foxes are vulnerable under NSW State legislation and grey-headed flying-foxes are vulnerable under State and Commonwealth legislation.

Records from Queensland indicate a majority of black flying-foxes getting entangled in netting. In NSW, it is predominantly the grey-headed flying-foxes that are affected. This reflects general trends in the distribution of the species. Spectacled flying-foxes are not affected by backyard netting to the same extent as black and grey-headed flying-foxes because they occur mainly in rural areas where backyard trees are not frequently netted.

### What to do in case of an entangled animal

- Check trees daily - regardless of the type of fruit tree protection used
- Do not attempt to release the animal
- Cover the animal with a towel to help calm it
- Call local wildlife rescue organisation or vet

### Some of the native wildlife entangled

| | |
|---|---|
| Currawong | Brown snake |
| Kookaburra | Green tree snake |
| Magpie | Red-bellied black snake |
| Rainbow lorikeet | Black flying fox |
| Raven | Brushtail possum |
| Sulfur-crested cockatoo | Grey-headed flying fox |
| Tawny frogmouth | Little red flying fox |
| Bearded dragon | Ringtail possum |

Threatened Species Network

Australian Government

WWF

The Threatened Species Network is a community-based program of the Australian Government and WWF Australia.

## PROTECTING BACKYARD FRUIT TREES

### The problem = bad netting

Backyard fruit tree netting is often put up incorrectly, leading to ineffective protection of fruit from animals and to unnecessary injury and death of native wildlife from entanglement in loose netting.

All types of netting incorrectly erected or just thrown over backyard fruit trees can be a disaster. However, the worst type is dark-coloured nylon netting, known as "Anti-bird Net" (pictured on the right). Animals find this netting hard to see and, as the fibres are so thin, they cut through the skin of entangled animals, leading to serious or fatal injuries.

Thousands of animals are rescued from backyard netting every year by volunteers from wildlife rescue groups. The many hours of volunteer work involved and the pain suffered by entangled animals can be avoided very easily by using appropriate materials for netting and by installing nets tightly over frames around trees.

### The solution = good netting

Three possible netting designs are described below. These designs ensure your fruit is protected and animals are safe.

**Shade cloth - medium 50% block**

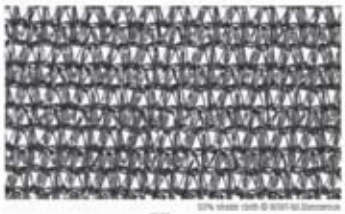
- For quick, temporary cover of trees while fruiting
- Easy to put up – throw over tree or fruiting branches and peg in place

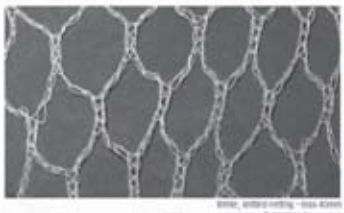
**Rectangular frame**

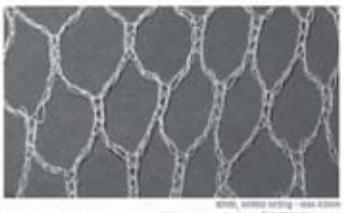
- Make frame from PVC pipe or timber
- Stretch white, knitted netting taut over the frame and fix securely to the ground

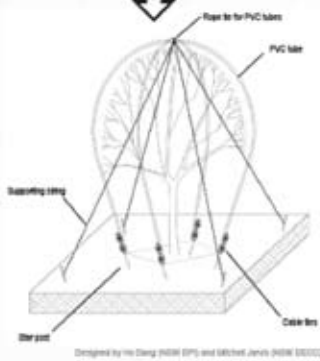
**Cross frame**

- Make frame from 4 PVC tubes (each arch will require two tubes connected at the top of the structure)
- Drive star posts at least 40 cm into ground and attach PVC pipes with cable tie as shown
- Stretch white, knitted netting taut over frame and secure with cable ties










This information provided by The Threatened Species Network and The World Wildlife Fund for Nature in association with the NSW Department of Environment and Climate Change. More information can be found at:
www.environment.nsw.gov.au/threatenedspecies/NettingOfCommercialFruitTrees.htm
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