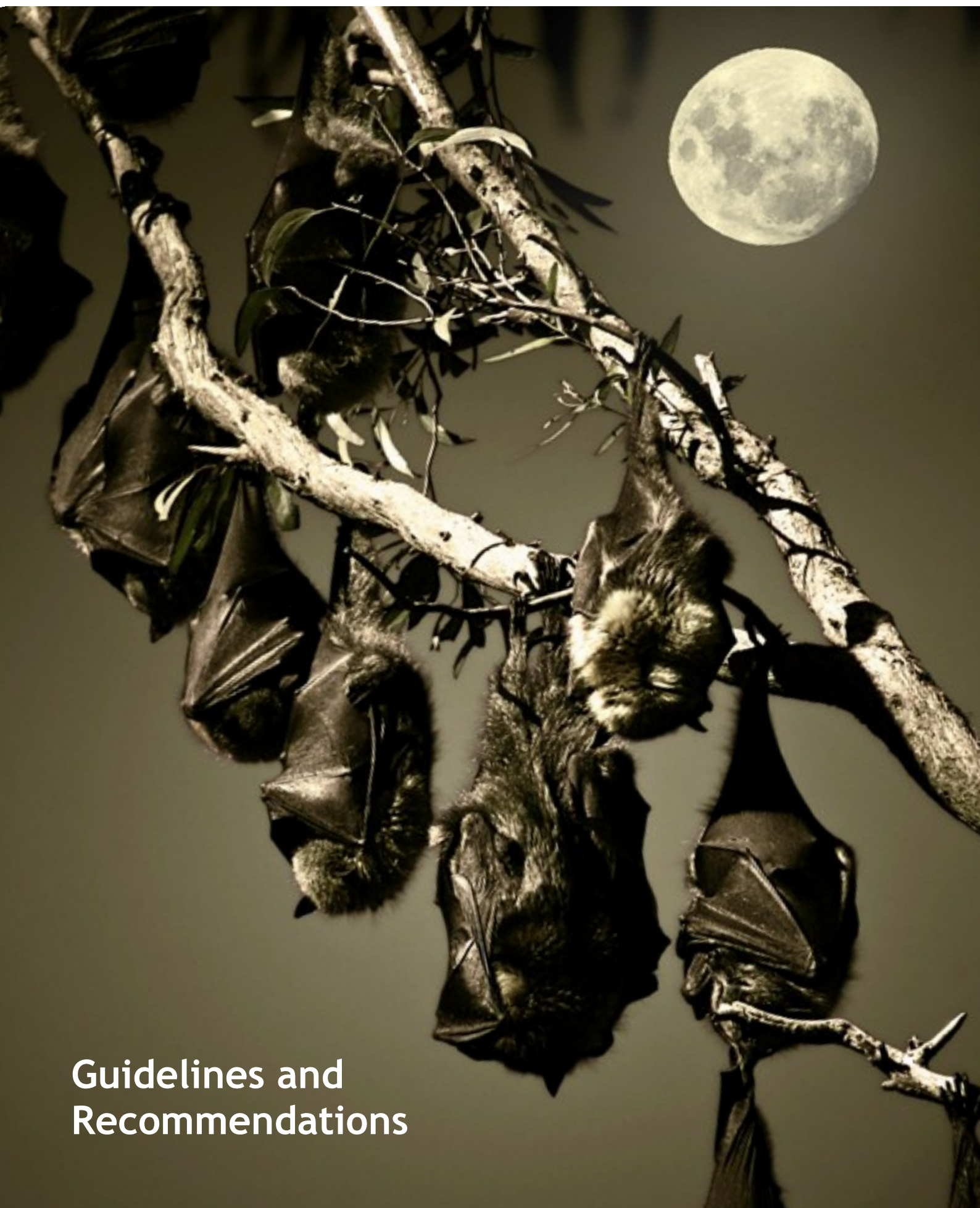


Management and Restoration of Flying-fox Camps



Guidelines and
Recommendations

This document is an output of the *Improving Landscape Resilience to Climate Change in SEQ: the flying-fox roost & forage conservation pilot project*, coordinated by SEQ Catchments Ltd and funded by the Australian Government's Caring for Our Country.

ISBN 978-0-9807088-9-9



Unless otherwise noted this book is licensed under a Creative Commons Attribution 3.0 Australia licence. You are free to copy, communicate and adapt this work, so long as you attribute SEQ Catchments. For more information see <http://creativecommons.org/licenses/by-sa/3.0/>.

August 2012

Disclaimer

The *Management and Restoration of flying-fox Camps: Guidelines and Recommendations* was prepared from the best available information at the time of preparation. It does not commit, or pertain to commit, SEQ Catchments or government agencies to implement, fund or otherwise resource specific activities or programs. Information in this document does not constitute legal advice. Any decisions made by other parties based on this document are solely the responsibility of those parties. The need to obtain independent advice should be considered prior to making any decision that may affect compliance with legislation.

More information

Email: admin@seqcatchments.com.au

Online: www.seqcatchments.com.au

Phone: (07) 3221 4404

Photos are all licenced through Creative Commons unless otherwise specified and are accredited as follows:

Front Cover Flickr aussiegall; Pg3 Flickr Tarique Sani; Pg7 Flickr Tony Rodd; Pg9 Flickr jimmuhk; Pg11 Flickr KajiFox; Pg13 Flickr wandrerstefan; Pg15 Top Flickr wollombi; Pg15 Bottom Flickr marj k; Pg19 Flickr Oystercatcher



CARING
FOR
OUR
COUNTRY

Background

The *Management and Restoration of flying-fox Camps: Guidelines and Recommendations* are the product of a forum on flying-fox camp management held at the EcoCentre Griffith University, Nathan, Brisbane, 7-8 July 2010.

The forum included presentations from prominent flying-fox researchers and case studies of the varying approaches to flying-fox camp management.

During workshop sessions, the 120 attending representatives from local, state and federal governments, community groups and other organisations from across eastern Australia, examined the current state of knowledge and through discussion developed a series of guiding principles to aid management of flying-fox camps. These principles, together with identified gaps in knowledge, requiring further investigation and research, are contained in this document.

The forum was part of the *Improving Landscape Resilience to Climate Change in SEQ: the flying-fox roost & forage conservation pilot project*, a two-year project aimed at improving the long-term sustainability of flying-fox camp sites in the South East Queensland region and increasing community awareness of the intrinsic value of flying-foxes and the critical ecosystem services they provide. The project was funded through the Australian Government's Caring for our Country program and supported by Brisbane and Redland City Councils, Moreton Bay Regional Council, Noah's Ark Wildlife Coalition, Bat Conservation and Rescue Queensland, The Hut Environment and Community Association and the Queensland Department of Environment and Resource Management. Additional funding support for the forum was provided by Brisbane City Council and Ecosure.

Acknowledgements

SEQ Catchments gratefully acknowledges attendees at the July 2010 forum and the subsequent contributions of individuals and organisations in the preparation of the *Management and Restoration of flying-fox Camps: Guidelines and Recommendations*. The involvement and guidance of Dr Peggy Eby and Billie Roberts in the design and facilitation of the forum and in the content and structure of this document were invaluable. Particular thanks are also due to members of the project's Steering Group – Melissa Cooper, Jenny Davis, Amanda Fox, Rachel Griffiths, John Hueston, Jenny Leask, Debbie Melville and Louise Saunders. Within SEQ Catchments, the contributions of Ben Barton (forum logistics), Joel Bolzenius (guidelines design) and Liz Gould (overall project coordination) are acknowledged. The contributions of persons representing the following organisations are appreciated:

Australian Bat Clinic
Bat Advocacy
Bat Conservation and Rescue Queensland
Bats Queensland
Biosecurity Queensland
Brisbane City Council
Burnett Mary Regional Group
Byron Shire Council
Cairns Regional Council
Department of Environment and Resource Management, Queensland
Department of Sustainability and Environment, Victoria
Department of Sustainability, Environment, Water, Population and Communities, Commonwealth
Eco Logical Australia Pty Ltd
Ecosure
GeoLINK
Gold Coast City Council
Griffith University

Ku-Ring Gai Bat Conservation Society
Lockyer Valley Regional Council
Logan City Council
Moreton Bay Regional Council
NatureCall
Noah's Ark Wildlife Coalition
Office of Environment and Heritage, New South Wales
Orange City Council
Queensland Conservation Council
Redland City Council
SEQ Catchments Ltd
Southern Cross University
Sunshine Coast Regional Council
Tweed Shire Council
Tweed Valley Wildlife Carers
University of Queensland
WIRES Northern Rivers NSW

Management and Restoration of Flying-fox Camps

Guidelines and Recommendations

CONTENTS

An Introduction to Flying-foxes	6
Biology and Ecology of Flying-foxes	6
Flying-fox Camps	8
Overview of Legislation Relevant to Flying-foxes	10
Setting Management Goals	10
Flying-fox Camp Site Restoration	14
Communities and Conflicts with Flying-foxes	18
Reading List	23
Appendix 1: Legislative and Policy Overview	25
Appendix 2: Forum Attendees	31



An Introduction to Flying-foxes

Over eighty different species of bat occur throughout Australia. Most of these bats have a diet that consists of insects, however several species feed primarily on flowers and fruit and are known as fruit bats or, due to their fox-like faces, flying-foxes. Flying-foxes are amongst the world's largest bats (often referred to as megabats) weighing as much as one kilogram with a wing span stretching over one metre. Flying-foxes are also highly adapted for activity at night, with large eyes particularly suited for recognising colour at night and a strong sense of smell; essential senses for finding their food.

Four species of flying-fox are native to mainland Australia and occur mostly in northern and eastern temperate and sub-tropical coastal areas: the little red flying-fox, the black flying-fox, the grey-headed flying-fox and the spectacled flying-fox. Refer images (not to scale) and distribution maps below.

Black flying-fox
Pteropus alecto

Photo: Les Hall & Steve Parish



Grey-headed flying-fox
Pteropus poliocephalus

Photo: Nick Edards



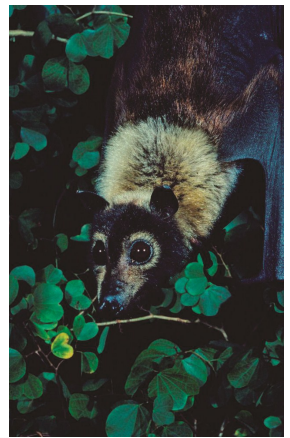
Little red flying-fox
Pteropus scapulatus

Photo: Kelly Coleman



Spectacled flying-fox
Pteropus conspicillatus

Photo: Les Hall & Steve Parish



Biology and Ecology of Flying-foxes

Diet and foraging

Flying-foxes feed primarily on blossom and fruit in canopy vegetation and supplement this diet with leaves. At any given time, the majority of animals feed on nectar from eucalypts, melaleucas and banksias. They have an extensive diet that includes over 100 species of native flowering trees and fleshy fruited trees and vines. This native diet is now supplemented by fruit of introduced plants such as garden and orchard fruit trees, street tree plantings, introduced palms and some noxious weeds such as privet.

Flying-foxes forage over extensive areas. Commutes of over 500 km have been recorded between camps and foraging areas, although foraging distances are usually around 20 km.

Ecological significance

Flying-foxes disperse the pollen and seeds of plants they visit during their foraging trips, and in this way they contribute to the reproductive and evolutionary processes of forest and woodland communities. Their mobility, size, territorial feeding activities, and colonising behaviour result in wide-ranging dissemination of pollen and seeds. Their ability to move freely among habitat types allows them to transport genetic material across fragmented, degraded and urban landscapes. Flying-foxes have been recorded as travelling over 400km in one night; their role as long-distance pollinators is unparalleled. It is also estimated that a single flying-fox can disperse up to 60,000 seeds in one night (DSE, 2011). Conservation of flying-foxes and their role within the natural ecology benefits many plants, other fauna and vegetation communities, including many listed as threatened under various pieces of legislation.

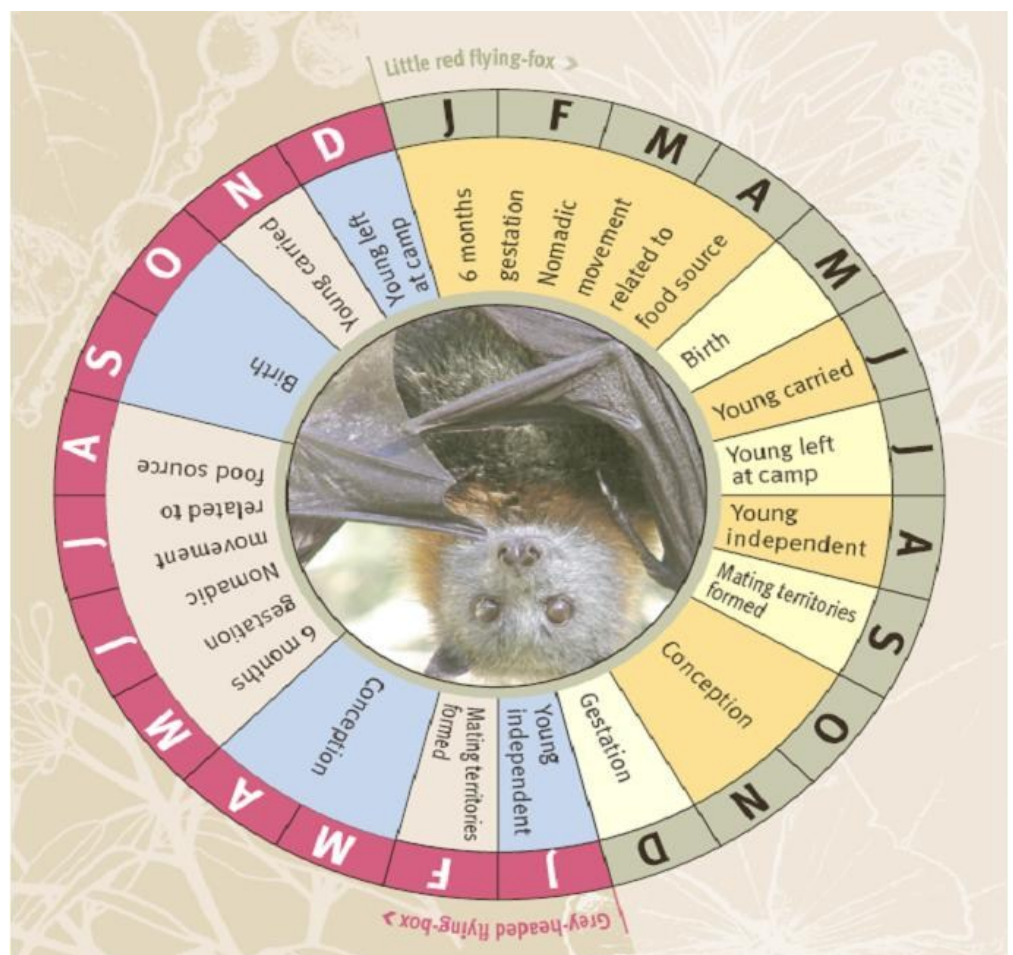
Flying-foxes digest most of their food within 15-20 minutes, so most ingested seed is deposited away from camps. However animals foraging close to camps are likely to bring plant seeds, native and exotic, back to camp with them. Small numbers of seeds of all sizes are carried in the mouth and can be transported long distances. Pollination is also often enhanced by flying-foxes carrying pollen grains on their fur.

Breeding

Reproduction in all Australian flying-foxes is seasonal and synchronous. However, recent observations of grey-headed flying-foxes suggest that synchronicity can be relaxed in years when environmental conditions are depressed and the population is under nutritional stress. The reproductive cycle of black and spectacled flying-foxes is approximately equivalent to that of grey-headed's (generally within two months). Mating behaviour in these flying-foxes commences in January, with conception usually in April or May. Females give birth to single pups in October or November and lactate until approximately March. The breeding cycle of the nomadic little red flying-foxes is out of phase with the other species by about six months (as illustrated in the calendar below). Individuals reach reproductive maturity in the second or third year of life. This low reproductive potential inhibits the capacity of flying-foxes to recover from population declines.

Breeding cycle of the little red and grey-headed flying-foxes in Queensland (courtesy Kathy Julian):

Note that this diagram should only be used as a guide. Climatic variables and local conditions often effect breeding activities, leading to significant variability in these timeframes. Careful observation and monitoring of flying-fox behaviour within the camp site is essential to determining their current stage within the breeding cycle.



Flying-fox Camps

A network of flying-fox camps can be found throughout their range. Camp locations are generally stable through time and several well-documented camps have histories of use that exceed 100 years. Flying-foxes have well-developed spatial memories to assist them in utilising their complex habitats, enabling individuals to remember the locations of camps and associated feeding sites. Little red flying-foxes appear to also establish temporary sites which are used for short periods and not revisited.

Flying-fox camps serve a number of functions. Their primary purpose is to provide suitable resting habitat within nightly commuting distance of food sources. They are also sites of information exchange and social behaviours such as those associated with reproduction and maternal care. In late spring and summer, camps provide refuge during the day for lactating females and their young. During the night camps provide safe refuge for flightless young while adults depart to feed.

Camps are highly structured. The majority of roost trees are occupied by mixed groups of adults comprised of a single male, who scent-marks and defends a territory shared by one or more females and their dependent young. The roosting positions of individual males are highly consistent and animals return to the same branch of a tree over many weeks or months. Some grey-headed flying-foxes are known to occupy a single area within a camp for several years, while others may return to the same branch of a tree after having migrated over large distances.

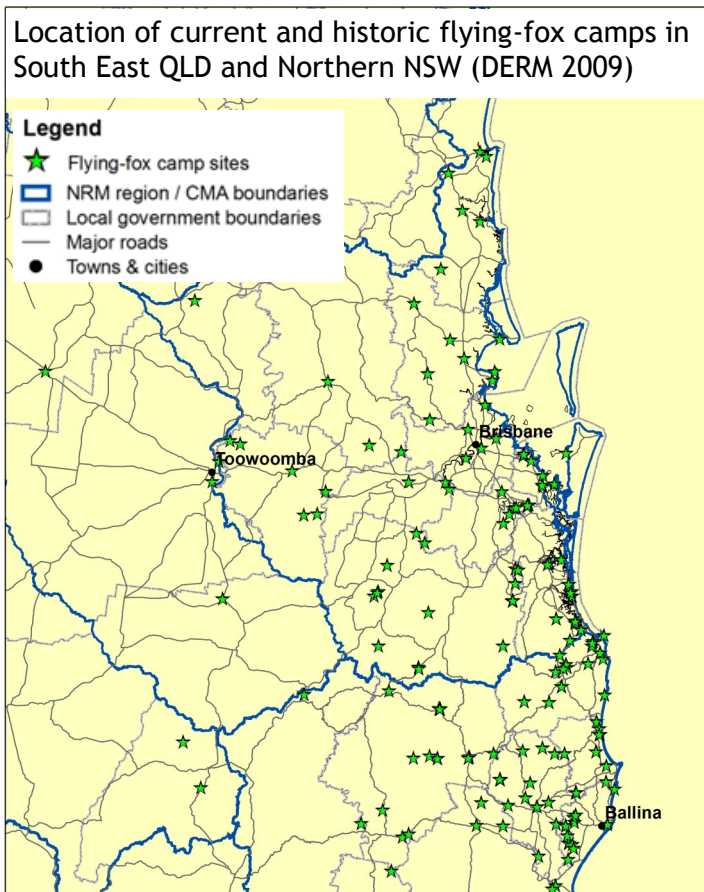
Flying-foxes often have a strong connection to camp sites and can be extremely resistant to relocation efforts.

Patterns of occupation of camps

The abundance of fruit and blossom within a 20-50 km radius of a camp site is a key determinant of the population size of a camp at any given time. Understanding the availability of foraging resources goes beyond general knowledge of usual fruiting and flowering times. The majority of eucalypts do not flower every year in a local area and several rainforest species do not fruit annually. The often erratic changes in camp size reflect the irregular nature of local food resources and the migratory responses of flying-foxes. All species move long distances as they track flowering and fruiting of species in their diet.

Production of fruit and blossom is thought to be related to conditions in previous seasons. Extended dry or wet periods, e.g. drought, may have a significant impact on local food availability. Consequently, the use of particular camp sites can vary enormously. At times camps may contain tens, hundreds or thousands of flying-foxes, or none. Some camp sites are occupied permanently, others seasonally and others irregularly. Camps associated with extensive areas of rainforest and those found in metropolitan areas where the range of diet plants is artificially diverse show the most consistent patterns.

The high mobility of flying-foxes means that in times of local food shortages, animals will migrate to other areas in search of food. In recent times, drought along much of the east coast has led to broad scale food shortages, causing deaths of adults and young and the exploration of new food sources. Importantly, migration is based on each animal's individual needs. Flying-foxes do not act as cohesive groups and camp sites should be considered loose assemblages of individuals.



Physical characteristics of camps

Research indicates that flying-foxes in coastal lowlands of SEQ and NSW choose to roost in vegetation with at least some of the following general characteristics:

- closed canopy at least 5m high
- complex vegetation structure - upper, mid- and understorey layers
- dense vegetation within 500 m of a river or creek
- within 50 km of the coastline or at an elevation < 65 m above sea level
- level topography, <5° incline
- at least one hectare in size
- large enough to accommodate and sustain large numbers of flying-foxes
- within nightly commuting distance (generally, <20 km) of sufficient food resources to support the population

Desired vegetation structure

Overstorey - resilient roost trees

Whilst a camp site canopy above 5 m is typically preferred by black and grey-headed flying-foxes, roost trees do not need to provide a dense canopy and even dead trees are frequently used. Tree health is an issue for camp site sustainability. Within any camp site, the trees used by roosting bats suffer to varying degrees. Some appear more resilient than others, e.g. *Ficus* sp. Resilient tree species are discussed later in the section on revegetation.

Mid-storey

The mid-storey vegetation within a camp site is considered critical for maintaining a cool, humid and sheltered environment to mitigate stress during drought and extreme temperatures.

Understorey

Bushcarers and staff working in camp sites have highlighted the correlation of dense understorey with the location of roost areas within a camp site. There are several documented cases of flying-foxes moving out of areas where the shrub and understorey layers have been cleared (typically for weed management). A dense understorey is thought to provide a desirable microclimate, improve microbial action and limit the movement of people, domestic animals, predators, etc beneath animals.

Impact of roosting flying-foxes on vegetation

Roosting flying-foxes defoliate trees as they move within camps. The individual spacing of the larger species, grey-headed, Black and spectacled flying-foxes generally limits the amount of structural damage done to trees to broken end branches. However, little red flying-foxes roost in very close proximity and the weight of roosting animals can break large branches and cause significant structural damage to roost trees. In addition, soil nutrient levels are elevated by faecal material.

Trees located in the most consistently occupied area of permanent camps (core area) are more likely to be affected than those in areas used by more transient animals. Cumulative impacts sustained over several years can lead to death of individual roost trees. Some tree species are more resilient than others. Observations in several permanent camps show that flying-foxes adjust the location of core roosting areas through time. In intact forest, this process of opening the canopy initiates a natural cycle of regeneration. However, in small remnant patches with significant edge effects especially weed invasion from surrounding areas, it is likely to increase the impact of invasive weeds, especially vines.



Overview of Legislation Relevant to Flying-foxes

Management of flying-fox camps and roosting habitat falls under the jurisdiction of a range of authorities and is regulated by Commonwealth and State legislation and the policies of local governments.

All flying-fox species occurring in Queensland and New South Wales are protected under State legislation, being respectively the *Nature Conservation Act 1992* and the *National Parks and Wildlife Act 1974*. The grey-headed flying-fox and spectacled flying-fox are listed as Vulnerable species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The grey-headed flying-fox is also listed as Vulnerable under the New South Wales *Threatened Species Conservation Act 1995*, Threatened under the Victorian *Flora and Fauna Guarantee Act 1988* and Rare under the South Australian *National Parks and Wildlife Act 1972*. The specific criteria and process for listing varies between each piece of legislation (refer to the relevant government websites for more information on this). Generally, however, grey-headed and spectacled flying-foxes are considered threatened due to a significant decline in numbers, resulting from loss of preferred feeding habitats and camp sites. This, combined with a slow reproductive rate (one young per year), the relatively long time for males to become sexually mature (approximately 30 months) given average life span is four years and the high rate of infant mortality, puts both species at risk of extinction (DSE, 2011).

Legislative status of flying-foxes in Australia

Species / Status	National	Queensland	New South Wales	Victoria	South Australia	Northern Territory
Grey-headed flying-fox	Vulnerable	Least Concern	Vulnerable	Threatened	Rare	
Spectacled flying-fox	Vulnerable	Least Concern				
Black flying-fox		Least Concern	Protected			Protected
Little red flying-fox		Least Concern	Protected		Rare	Protected

It is the responsibility of all people seeking to do works around or in camps that they comply with these various pieces of legislation. Criteria for assessing if an action is likely to have an impact are outlined in Appendix 1. This will be particularly relevant for activities that involve the removal or modification of vegetation (native or exotic) and/or may result in the disturbance of animals. For example in Queensland camp disturbance or destruction is prohibited unless approval has been granted through a damage mitigation permit (DMP) from the Department of Environment and Heritage Protection.

Camp sites of flying-fox species are often located in significant vegetation communities, protected under the same or other legislation as flying-fox species. It is recommended that you seek advice from the relevant Local, State and Commonwealth agencies before undertaking disturbance activities.

Setting Management Goals

Determining a vision or aim for a camp site will assist with determining the actions required to achieve that vision. For example, is the aim to ensure camp sustainability or to undertake ecological restoration of the site?

Realistic aims for appropriate flying-fox camp management are site specific and will vary between sites depending on conservation values and the risks (such as health and safety issues related to site access) and/or threats (such as weed species that may be impacting upon the flying-fox roost) present at individual sites. Flying-fox camp sites are highly modified ecosystems and when compared with works on a similar site that don't involve a flying-fox roost are likely to:

- take longer to restore
- require planning and works over a larger area, including appropriate management of buffer zones
- need greater resources
- require a greater focus on community engagement

Acceptance and incorporation of these factors into a management strategy is required to gain and maintain community and political support and motivate personnel directly involved with site management.

The need to maintain site suitability in the context of current and ongoing use by flying-foxes will be a key factor in determining management goals.

Establishing realistic aims

To effectively manage a flying-fox camp site, a prioritised plan is needed that covers aspects of time, space and scale in relation to the specifics of the site, bearing in mind specific objectives or outcomes for the site.

Considerations for determining camp site management aims include:

- Current pattern and history of utilisation by flying-foxes
- Site health and sustainability
- Community needs and concerns
- Available resources
- Site buffers

Determine camp utilisation by flying-foxes

Understanding how flying-foxes use a particular camp is critical to its management, and will require investigation and consideration of current, long-term and historical use of a site.

Key questions to consider:

- Which species use the camp site?
- Is the camp occupied permanently, seasonally or irregularly?
- What part/s of the site is used?
- Is the camp a maternity site?
- Have there been changes to how or what part of a site is used? Is there a pattern to this?
- Is current usage consistent with historical use?

Species considerations

Reproduction in flying-foxes can be disrupted by inappropriate activities. Generally, major works are best scheduled outside critical reproductive periods (late gestation, lactation, mating) and in some instances it is illegal to conduct activities during these periods. Activities can be scheduled at other times, however this needs to be done under careful management built on an understanding of how flying-foxes use the site combined with monitoring of the response of animals to any works. Ensure you discuss proposed works with a local flying-fox expert to ensure that impacts can be minimised.



The timing of the reproductive cycle varies between species and may also vary between regional areas. For example, in camp sites in SEQ and NSW that contain grey-headed or black flying-foxes, major works should be scheduled between May and July, however this may differ in other regions. At the time of publication, however, research is underway on the relationship between Hendra outbreaks and flying-fox stress, with preliminary evidence suggesting a higher frequency of outbreaks in winter months.

When little red flying-foxes arrive they can dramatically increase the number of bats at a camp site, often spilling over into neighbouring areas. Whilst this only lasts a few months, it can cause considerable upset both within the colony and amongst its human neighbours, and cause significant damage to trees and other vegetation at the site. Little red flying-foxes are easily disturbed and the level of damage to vegetation increases with increasing movement within camps.

Although little red flying-foxes are particularly susceptible, any disturbance to a flying-fox camp can be harmful and is against the law in some states. Check with your relevant wildlife management authority before undertaking works that may disturb flying-foxes or their camps.

Recommendations:

- In SEQ and NSW avoid major works in camp sites between August and April (based on current information on flying-foxes; the results of future research, e.g. Hendra linkages, will need to be considered as it becomes available)
- Avoid works at sites where little red flying-foxes are present

Consider timing and length of camp occupation

An understanding of patterns of camp occupation will assist with predicting areas in need of focussed attention and long-term planning of vegetation works.

Example:

Mapping of the area used by roosting resident and visiting flying-foxes at Ku-ring-gai Flying-fox Reserve between 1978 and 2010 (Palin, N. *et.al.*), has shown large differences in the roost patch size and location within the Reserve. These changes occur within and across seasons and years. During this time, the number of roosting animals has ranged from nil to >70,000, with no obvious pattern or predictability to usage, though increases in flying-fox numbers have been linked to food availability, e.g. abundant and widespread flowering of red bloodwoods (*Corymbia gummifera*), and during the mating season.

Recommendations:

- Identify foraging resources within the wider landscape and patterns of fruiting and flowering
- Monitor flying-fox numbers at and usage of the camp site
- Establish a map of current and historical usage of the roost site that records seasonal and yearly variability

Ensure flying-fox camp site health and sustainability

Providing the availability of local foraging resources remains constant, for a colony to remain at a site the vegetation patch in which the animals roost needs to maintain a suitable structure and provide an appropriate micro-climate for the short, medium and long-term. Long-term persistence at a site is desirable for community and planning certainty, as well as for flying-fox conservation and landscape health. Suitable vegetation structure and patch micro-climate are primarily determined by the plant species present on the site and their configuration.

The higher nutrient levels within camp sites, combined with the constant reintroduction of weed seed brought in from other locations by flying-foxes, other fauna, wind, water and people, means weeds will be present at most camps for at least the short to medium term.

Repeated use of particular roost trees by flying-foxes can lead to damage and loss of plants. This is exacerbated during influxes of large numbers of bats due to local food availability.

So, how can management of an existing camp site support long-term sustainability?

Desired patch size

Determining optimal vegetation patch size for a flying-fox camp will depend on management intent: ensuring camp sustainability or undertaking ecological restoration.

If managing the patch solely as a flying-fox camp, i.e. without considering other ecological needs (which isn't often practical), the appropriate area will depend partly on the number of animals present and the vegetation community present. The following information is presented as a guide:

Camp size	Approx. no. of flying-foxes	Approx. area occupied at any one time	Minimum patch size (allowing for movement)
Large	50,000	3 hectares	10 hectares
Small	10,000	0.75 hectares	3 hectares

In general, the area required for an ecologically sustainable remnant will be significantly larger than the area needed to cater for flying-foxes alone, requiring at least 50 hectares of intact vegetation.

Regardless of management intent, a buffer around the camp will help minimise conflict with humans. The buffer should comprise vegetation not suitable for roosting and be at least 300 m wide (refer section on buffers later in this document for more details). In coastal areas, the potential impact of sea level rise should be factored into buffers and patch size.

It may be possible for a number of small, closely positioned patches which are used in combination to be considered and managed as a single camp.



Flying-fox Camp Site Restoration

A number of permanently occupied flying-fox camps are sites of ongoing bush regeneration and restoration programs which have been in place for many years and are of various scales. Some NSW examples include Ku-ring-gai Flying-fox Reserve (Gordon, Sydney), Bellingen Island, Wingham Brush, Lumley Park (Alstonville). Evidence from these sites suggests that bush regeneration and restoration can counter the impacts of flying-fox camps on small patches of vegetation.

Camp site restoration requires an understanding of the site utilisation by flying-foxes, identifying community needs and determining an action plan that includes:

- Appropriate restoration techniques
- The role, impact and extent of weeds
- Assisting natural regeneration, particularly new roost trees
- Other native species using the area
- Managing pest or feral species
- Increased nutrients from colony
- Determining fire risk and appropriate mitigation measures
- Topography
- Water availability
- Likely changes to site conditions arising from climate change
- Monitoring and review

Before you begin

Contact the relevant national, state and local government authorities to determine the need for and compliance with any required permits or approvals.

Undertake an occupational health and safety risk assessment to determine the appropriate levels of personal protective equipment required. Workers should be made aware of the potential health risks associated with working with flying-foxes, particularly Lyssavirus, apply appropriate personal hygiene and understand the specific actions to take in the event of being bitten or scratched by a flying-fox. Contact with flying-foxes should be avoided. Relevant state government agencies, local council officers or wildlife carers should be contacted immediately if sick or injured flying-foxes are found.

Restoration techniques

Site usage by flying-foxes will determine the type and timing of bush restoration activities. In particular, there is a conflict between the preferred timing for most weed control (usually spring-summer) and avoidance time for flying-foxes due to breeding (also spring-summer).

Regularly monitor roosting bats for signs of disturbance, e.g. taking flight, loud protest squeals. If bats appear to be disturbed, cease activities in the area. The sensitivity of bats to disturbance appears to vary from site to site, presumably in response to habituation to 'usual' disturbances. In general, little red flying-foxes appear to be more easily disturbed than other species and do not habituate.

If works must be undertaken when flying-foxes are present, for example in a continuously occupied camp, the following techniques may minimise disturbance:

- avoid machinery and activities that create a lot of noise or vibration
- avoid activities during times of environmental stress, e.g. extreme weather (excessively hot (over 30 deg), cold or windy days), food shortages
- use small skilled teams working in clusters in a mosaic pattern
- allow animals time to habituate at low intensity of work (there is potential to introduce machinery slowly)
- restore habitat outside current roost area, e.g. in old roost areas, potential roost areas, foraging areas
- have a licensed spotter/catcher on site to monitor the behaviour of flying-foxes. If works are causing the animals stress the spotter should notify the works crew immediately.

Examples:

- Cascade Gardens, Broadbeach, Bellingen Island, Wingham Brush: volunteer bushcarers are able to work under bats without any signs of disturbance.
- Black Swamp, Cleveland: disturbance caused by a neighbouring development has been associated with the departure of bats from the camp (though the bats may have moved on for other reasons, e.g. limited local food supply), and their consequent resettlement in a new, contentious location.
- Mt Ommaney: understorey removal thought to have led to flying-fox departure.

Weed extent and impact

Is there an acceptable level of weed infestation? Yes, at least in the short term.

At many camp sites, weeds provide roosting areas for flying-foxes. If not carefully managed, weed removal may negatively impact the value of the site to the animals or increase roosting pressure on remaining vegetation. In addition, increased nutrient levels within camp sites, particularly phosphorus (typically in low concentrations in Australian soils) favour growth of exotic species. This combined with the reintroduction of weed seeds to the site by flying-foxes, other fauna, wind, water and people, means weeds will be present at most camps for at least the short to medium term.

Within the camp site, prioritise weed control in areas known to be used by roosting bats, but which are not currently being used, with the aim of returning these to usable areas. Weed control needs to be site specific and staged, i.e. change the structure of the vegetation slowly, with gap plantings to facilitate recovery. It is also important to take into account management techniques for different ecosystems. For example management in rainforest ecosystems will be different to that of a *Melaleuca* wetland.

A longer term goal may be to remove all weed species and replace with native species that provide a similar structure, aiming for eventual restoration of ecosystem function.

The short term goal for weed management should be to remove priority and transformer weeds. These include:

- vine weeds that threaten roost tree survival, e.g. Madeira vine, morning glory, asparagus vine, cat's claw creeper, corky passionfruit, balloon vine
- understorey weeds that prevent natural regeneration, e.g. Singapore daisy, Lantana - though this should be done with caution, refer to staging of activities section)
- weeds that cause harm to flying-foxes, e.g. cocos palms
- weed species that provide food for flying-foxes

Methods of weed control and facilitated regeneration

Best practice use of herbicides may be necessary for time and cost effective weed control within a roost site. Little evidence exists to suggest that use of herbicides impacts on roosting flying-foxes, provided:

- legislative and licensing requirements of use are adhered to, particularly given most roost sites are near waterways;
- direct application techniques are used (eg. cut and paint, stem injection, stem scraping), high wind conditions are avoided, foliar overspray is avoided



Other techniques:

- Consider introduction of appropriate bio-controls
- Pile burn to stimulate seed regeneration (appropriateness will depend on native flora present on site and time of year). Fires should not be lit near roosting flying-foxes.
- Rip or otherwise disturb the soil by hand, with machinery, or other means, to encourage mass germination of she-oaks, melaleucas, eucalypts. Ensure activity does not disturb flying-foxes.
- Plant figs into weed trees, e.g. camphor laurels, Chinese elms. This may not be practical given required timeframe to be effective.
- Plant where necessary to prevent areas of bare earth and facilitate site recovery.

Education of the local community and neighbouring land managers regarding weed identification and preventing spread is particularly important given the difficulties of weed control within a flying-fox camp site. Removing weed species that are a food source for flying-foxes and other fauna from the area surrounding camp sites reduces the potential reintroduction of these weeds into the camp and their subsequent spread to other areas.

Staging of activities

The area being used for roosting by flying-foxes will vary between years, during a year or even within a season. Planning and staging camp restoration activities needs to consider current and potential future use of a camp site. Broad-scale restoration may render the entire site unsuitable for flying-foxes, due to changes brought about in vegetation structure and composition.

So, how much change in vegetation composition and structure can be tolerated by flying-foxes?

There is limited objective data available to answer this important question. General consensus is that the amount of change tolerated by the animals varies depending on the camp population, vegetation patch size and the buffer area. If sufficient space exists, flying-foxes can move around a camp site to alternative roost areas. This occurs naturally if over-use by flying-foxes has led to denuding of roost vegetation and structural damage. This flexibility can be used by camp managers to schedule restoration activities.

Observation at one site on the Gold Coast in 2011 on the impacts of vegetation removal and modification, however, found that the threshold where flying-foxes began naturally abandoning this site coincided with 75% removal of the understorey and 30% of the canopy. These activities were undertaken as a 'passive dispersal' granted under a Damage Mitigation Permit issued by DEHP and were staged over several weeks, undertaken at night and resulted in removal of the entire understorey and selective removal of roost trees.

Further research is needed to determine if there are general guidelines on flying-fox tolerance levels or thresholds which can be applied to activities. In the absence of better information, however, a conservative approach which includes the following considerations can be applied to improve understanding and make informed decisions based on best available local information:

- Monitor movements of the core roost area to ascertain relative importance of areas within the site and preferred vegetation structure and composition
- Utilise skilled staff and volunteers to undertake restoration and rehabilitation - to identify natural regeneration, determine restoration methods and select appropriate species and placement when revegetating
- Minimise the impact of change through staged removal of weed species, particularly if this is the dominant vegetation, with short bursts of activity in a mosaic pattern

Research

- Comparative microclimate analysis of roost areas and camp sites
- Identifying tolerance thresholds for camp site modification

Revegetation

Depending on species, trees planted within the core camp area may take 6-8 years before they reach 5m and are used by flying-foxes for roosting (e.g. acacias at Coffs Creek, Wingham Brush). If trees are planted at the edge of the camp rather than in gaps within the camp, this can increase to 10 years.

Succession species appropriate to the vegetation community (e.g. acacias, casuarinas, white cedar), are usually most suitable to rapidly establish new roost habitat; providing roost sites and contributing to ecological restoration of the camp. The introduction of fast growing exotic or non-local native species needs to be considered carefully in the context of longer term outcomes and potential weediness.

Understanding which tree species may be more resilient to damage from roosting animals than others can help guide revegetation activities. Resilient roost trees need the following qualities in addition to ecosystem specific attributes:

- resilient to defoliation, e.g. stinging trees and red ash (*Alphitonia excelsa*) which are frequently denuded by insects
- tolerant of high nutrient levels (high phosphorus benefits weeds, but impacts many native species)
- resistant to soil pathogens
- thick bark (resistant to damage from claws)
- AVOID species with terminal growth points that are broken off by flying-foxes

The potential for artificial structures to augment roosting habitat in current camp sites and to provide new roosting habitat outside current camps, e.g. away from community conflict areas, is an area requiring further investigation.

Trials of artificial structures at Cascade Gardens, Broadbeach and at Hervey Bay have had limited success with only very small numbers of bats observed using the suspended ropes installed at both sites.

- At Cascade Gardens, the open structure of the vegetation below the ropes is thought to have been a deterrent to flying-fox use and moving the ropes to above more suitable vegetation is to be trialled.
- At Hervey Bay, bats only used ropes within a metre of the trunks of usual roost trees.
- Three structures placed at Woodend, Ipswich (one of which is pictured right) have not been used by flying-foxes since their installation in 2009. Activation of these artificial roosts would be part of a broader strategy for flying-fox management in that location.
- An artificial roost trial is planned at Coffs Creek.



Considerations

- Link trials of artificial structures to the release of captive animals that are accustomed to using artificial roosts
- The position of artificial structures within the camp is likely to be important, e.g. proximity to existing roost trees, complex vegetation structure

Research

- Identify the significance of understorey (structure, composition, density) to determining location and management of roosting areas
- Are the characteristics of current roost areas and camp sites optimal conditions or the result of limited choice? Is it possible to identify optimal conditions to aspire to?

Monitoring and review

Given current lack of detailed knowledge on the use of camp sites by flying-foxes, monitoring, review and adaptive implementation of a camp restoration action plan is essential.

Particular areas to focus on include:

- population counts over time and mapped usage patterns in camp
- response of animals to restoration activities
- response of vegetation and particular tree species to flying-fox usage
- involvement of flying-fox experts in action plan development and review
- informed supervision of action plan implementation, monitoring and review

Communities and conflicts with flying-foxes

Widespread and ongoing clearing and modification of native vegetation has caused substantial decrease in flying-fox foraging and roosting habitat. For example, 61% of native vegetation cleared in Queensland between 2000 and 2010 has consisted of medium trees (10-30m) in which flying-foxes commonly forage and roost (Birt, 2010). Consequently, flying-foxes are moving into camps near urban areas where food (native and exotic) is generally locally available all year round. The issue is compounded through urban encroachment into areas historically or irregularly-used by flying-foxes as camp sites.

Flying-foxes appear to be undeterred by the presence of people and the undertaking of day-to-day human activities. However local residents and other members of the community who reside in close proximity to flying-fox camps often complain of smell, mess (faeces), and noise generated by large aggregations of animals. Disease concerns are also regularly expressed.



It is essential that local communities and the general public are actively engaged and their concerns are dealt with when working in or around flying-fox camps.

The *Management and Restoration of Flying-fox Camps* forum (7-8 July 2010), where much of the information for this publication was compiled, recognised the significance of flying-foxes to the broader environment and the importance of their camps in the life histories of the animals. Discussions were based around the need to actively manage camp sites to ensure the longevity of the vegetation and its suitability as roosting habitat, for nature conservation outcomes and also to provide some level of planning and community confidence, and to reduce conflict between flying-foxes and humans. The intentional dispersal of flying-fox camps from one location to another was not considered at this forum.

Key strategies for mitigating conflict:

- create buffers around camps to provide a physical separation between humans and flying-foxes
- actively manage vegetation structure and composition
- engage the community to gain acceptance and support for in-situ management

What comprises an effective buffer?

Buffers can be visual or used to mitigate noise and smell. A physical separation between humans and flying-foxes is a good way to reduce conflict with the surrounding area.

If possible, land-use planning instruments should be used to provide sufficient space between established camp sites and residential and industrial neighbours. Camp site boundaries and buffers should take into consideration the variability of use of a camp site by flying-foxes within and across years. Particularly, buffers need to cater for large, seasonal influxes of flying-foxes, as these often trigger greater community concern.

A buffer of 300m is ideal, however in many instances this is not possible and the buffer width should be as wide as the site allows. The buffer area should consist of habitat not used by flying-foxes e.g. low trees <3 m, cleared land, rivers, open space. Note: sparse plantings surrounding camps can be used by flying-foxes as roosts and should not be included in the buffer zone. Consideration of topography and prevailing wind direction will assist with determining where compromises can be made. The usefulness of the buffer to reduce the impacts of smell and noise declines if less than 50m.

If a sufficient buffer cannot be established, appropriate management of vegetation structure around the edges of a camp site can help reduce conflict (see following section). In addition, appropriate design of buildings and infrastructure, e.g. walkways, in and around camp sites (not discussed in this document) may help mitigate community concerns.

Example

- In areas surrounding the Ku-ring-gai Flying-fox Reserve (Gordon, NSW), the local council has included information regarding properties proximity to flying-fox camps in the Section 149 Planning Certificate. Section 149 Planning Certificates are issued in accordance with the *Environmental Planning and Assessment Act 1979* and contain information on how a property may be used and restrictions on development.

Research required

- Effectiveness of man-made structures as a buffer to mitigate smell and sound of colonies, e.g. sound barriers used on motorways.
- Minimum width of buffers to reduce concerns of noise, smell or droppings.
- Does less disturbance result in less smell to neighbouring areas.

Using vegetation structure to manage conflict

Vegetation structure at camps can also be used as a tool to manage conflict with neighbours. The outcomes using vegetation structure are more definite than some other management tools, e.g. camp relocations, but may not alleviate all the community's concerns.

Potential vegetation management techniques to consider include:

- Vegetation trimming
- Vegetation removal
- Revegetation

Vegetation trimming or removal may require a permit, licence or other approval depending on vegetation protection or management requirements of state and/or local governments. For example, in Queensland vegetation removal may require approval under the *Vegetation Management Act 1999*, *Sustainable Planning Act 2009*, *Water Act 2009* or *Nature Conservation Act 1992*.

Vegetation trimming

Purpose: To create a small buffer between humans or conflict areas and the flying-fox colony.

- Small-scale lopping has been used to move flying-foxes away from minor areas of conflict on the fringe of the camp.
- Can be used to establish good will and build relationships and tolerance with neighbours.
- Vegetation should be trimmed by a qualified arborist so trees remain viable and do not become a safety issue in the future.
- Consider the timing of trimming as some tree species need to be pruned at certain times of the year.

Vegetation removal

Purpose: To create a substantial buffer between humans/ conflict areas and the flying-fox colony.

- Must take into account the size of the vegetation patch.
- Avoid removing vegetation in small vegetation patches.

- Should only be considered in large remnants or at sites with extreme and ongoing conflict and the consequences of doing nothing could have a negative impact on the animals.
- Aim for no net loss of vegetation used by bats
- Impact on other wildlife and the vegetation must be considered
- Independent assessment process required

Revegetation

Purpose: To create a visual buffer in conflict areas, make areas of the colony inaccessible to humans or extend the camp vegetation away from residents.

- Improve the core area or extend the remnant with roost trees to bring animals back to preferred areas and prevent animals spilling over into neighbouring properties
- Edge planting with low growing thorny and spiky plants to prevent people from entering the camp, disturbing the colony or interfering with regeneration
- Edge plantings must be <3m high to prevent flying-foxes from roosting in these areas.
- Revegetation is a longer-term management tool as takes some time for trees to grow and be utilised by flying-foxes.
- Revegetated areas should be of sufficient height and maturity that they can be used by roosting flying-foxes before undertaking any modification of existing vegetation. Planting young trees at the same time as removing roosting habitat may displace and stress bats; the potential negative consequences of this for bats and people is discussed elsewhere.

Examples

- Trees removed and branches trimmed to create a buffer to walkways and buildings at Maclean High School, NSW in conjunction with replanting areas away from the school for flying-fox usage.
- Lopping of branches in residential backyards adjacent to the Helensvale, Qld camp.
- Limbs and trees removed along the boardwalk at Dunwich, North Stradbroke Island, camp to reduce droppings and slipperiness of path.
- Replanting roost habitat for flying-foxes away from conflict areas at Woodend, Ipswich.

Research required

- What is a viable/ sustainable area for a camp relative to camp population?
- Can the use of mulch e.g. camphor laurel, teatree, eucalypt, be used for smell absorption?
- What is the impact on flying-fox camps from machinery use?

Considerations

Any vegetation works and maintenance should be undertaken in such a way to minimise disturbance to the colony, but recognizing that temporary disturbance may be unavoidable in some circumstances. Activities should also be closely monitored by a person with suitable experience in bat behaviour.

Noise from two stroke engines such as chainsaws, whipper snippers and lawn mowers are the most disruptive to roosting flying-foxes and if possible should be avoided. Planting areas near the camp that require regular mowing with low shrubs (< 3m), preferably in a mulched bed, would reduce regular disturbance from maintenance works.

Offset planned loss of roosting habitat, including weeds, as a result of trimming or vegetation removal. The amount to offset will vary with site and the amount and type of vegetation cleared. Could be a ratio anywhere from 2:1 to 10:1.

To reduce the possibility of disturbing the colony and dispersing bats to less desirable locations, where possible any major works near the camp site involving machinery or construction should be carried out:

- outside flying-fox reproductive periods, i.e. avoid conducting works between August and April.
- when flying-foxes are absent or numbers are at their lowest.

NB. Permits and/or approvals from Commonwealth, state and local governments may still be required.

Gaining community support

Gaining community tolerance or support for a flying-fox camp allows for more flexible management and makes its long-term sustainability much more feasible.

Key messages in community programs should include information such as:

- The benefits of having the camp in its current location.
- Unfeasibility of other management options, such as relocations.
- It's not just about bats, there are other ecosystem benefits.
- Factual information about public health and other community concerns regarding flying-foxes.

Public education strategies must consider what, when and how you want to get your message across to the community. Take into account high emotions and try to identify the main issue/s causing concern. All stakeholders need to be involved, including the main complainants, neighbours, bushcare groups, wildlife care groups, horticulture and equine groups, etc. Political support, either from elected representatives or high profile members of the community, as well as general community support is needed.

Methods for promoting public education and tourism at flying-fox camps

- Early intervention - get your message out to stakeholders
- Coordinate public meetings to listen to complaints, document discussions, get feedback on usefulness of the meetings
- Monitor the outcomes of camp restoration activities, etc and relay these to the community
- Face-to-face interpretation
- Present a hand-reared flying-fox at a school or field day and explain their ecology this is thought to be one of the most effective ways to gain public appreciation
- Involve stakeholders, e.g. bat care groups, health authorities, in the education process
- Establish viewing platforms with interpretive signage and binoculars to view animals
- Install interactive signage that changes with season and activity
- Conduct community activities such as plantings at flying-fox camps, Halloween movie nights, information nights at flyout
- Develop school education programs with hands-on activities and target supportive teachers
- Appoint a liaison officer for each camp
- Consider approaching a high profile celebrity to promote bats
- Utilize or create an environmental education centre
- Run batty boat cruises or similar interpretive activities
- Install a bat cam



Examples

- Coffs Creek, Coffs Harbour NSW where intensive community consultation changed perceptions and reduced complaints from the community.
- Various camps incorporate viewing platforms and interpretive signage including Melbourne, Cabramatta, Cascade Gardens and Hervey Bay.
- Halloween movie night and information sessions at the Stafford, Brisbane colony

Considerations

- Currently there is a lot of public education material available so there needs to be a central location for all the available material
- Need to attempt to get a consistent message at all camps
- Educational material should be electronic for distribution
- National/ state wide Education Strategy needed.
- Public education needs to be ongoing and adaptive - the use of different approaches required to get the message across.
- Use analogies that people can relate to
- Targeted, timely and empathetic information, e.g. horse owners / industry after Hendra spill over events, fruit growers during shortages of flying-fox's natural foods, camp neighbours prior to arrival of little red flying-foxes.

Research required

- Evaluation of the effectiveness of different approaches including baseline surveys of community attitudes, such as that done at Ku-ring-gai Flying-fox Reserve in 2001.

Reading list

- Birt, P., Markus, N., Collins, L. and Hall, L.S. (1998). Urban flying-foxes. *Nature Australia* 26:54-59.
- Booth, C. and Low, T. (2005). Conservation Status Review of Flying Foxes in Brisbane City. For Brisbane City Council.
- Department of Environment and Resource Management, Queensland (2011). Living near flying-foxes... health and conservation issues answered.
- Department of Environment and Resource Management, Queensland (2011). Living near flying-foxes... Frequently asked questions.
- Department of Environment, Climate Change and Water NSW (2007). *Flying-fox camp management policy*, Department of Environment and Climate Change NSW, Sydney
- Department of Environment, Climate Change and Water NSW (2009). Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney. <http://www.environment.nsw.gov.au/resources/threatenedspecies/08214dnrpflyfox.pdf>
- Department of Sustainability and Environment, Victoria (2011). About flying-foxes. <http://www.dse.vic.gov.au/plants-and-animals/flying-foxes-home-page/flying-foxes-about-flying-foxes>
- Department of Sustainability and Environment, Victoria (2005). Flying-Fox Campsite Management Plan: Yarra Bend Park.
- Department of Sustainability and Environment, Victoria (2009). Yarra Bend Park Flying-fox Campsite: Review of the Management Plan. Also published on www.dse.vic.gov.au/flyingfoxes
- Department of Sustainability and Environment, Victoria (2009). Yarra Bend Park Flying-fox Campsite: Review of the Revegetation Plan. Also published on www.dse.vic.gov.au/flyingfoxes
- Department of Sustainability and Environment, Victoria (2009). Yarra Bend Park Flying-fox Campsite: Review of the Scientific Research. Also published on www.dse.vic.gov.au/flyingfoxes
- Coffs Harbour City Council (2007). Coffs Creek flying-fox Camp and adjacent Reserve. Vegetation management Plan. http://www.coffsharbour.nsw.gov.au/resources/documents/Flying_Fox_Camp_Vegetation_Mgt_Plan1.pdf
- Eby, P. (1991) Seasonal movements of grey-headed flying-foxes, *Pteropus poliocephalus* (Chiroptera: Pteropodidae), from two maternity camps in northern New South Wales. *Wildlife Research* 18:547-559.
- Eby, P. (1996) Interactions between the grey-headed flying-fox *Pteropus poliocephalus* (Chiroptera: Pteropodidae) and its diet plants - seasonal movements and seed dispersal. PhD Thesis, University of New England, Armidale, NSW.
- Eby, P. (1998). An analysis of diet specialization in frugivorous *Pteropus poliocephalus* in Australian subtropical rainforest. *Australian Journal of Ecology* 23:443-456.
- Eby, P. and Palmer, C. (1991). Flying-foxes in rainforest remnants in northern New South Wales. pp. 48-56 in *Rainforest Remnants*, edited by S. Phillips. NSW National Parks and Wildlife Service, Lismore.
- Eby, P. and Law, B. (2008). Ranking the feeding habitats of grey-headed flying-foxes for conservation management. A report for the Department of Environment and Climate Change and Water (NSW) and the Department of Environment, Water, Heritage and the Arts. Some chapters available at: <http://www.environment.nsw.gov.au/resources/threatenedspecies/GHFF08UNENSW.pdf>
- Eby, P. and Lunney, D. (Eds) (2002). Managing the Grey-headed Flying-fox as a Threatened Species in NSW. Royal Zoological Society of NSW, Mosman.

Geolink (2010). Final Maclean flying-fox Management Strategy. Prepared for Clarence Valley Council and Department of Environment, Climate Change and Water on behalf of the Maclean flying-fox Working Group. http://www.geolink.net.au/index.php?row=622&field=05_FileList_document

Hall, L.S. and Richards, G. (2000). Flying-foxes: Fruit and Blossom Bats of Australia. UNSW Press, Sydney.

Larsen, E., Beck, M., Hartnell, E. and Creenaune, M. (2002). Neighbours of Ku-ring-gai Flying-fox Reserve: community attitudes survey 2001. In *Managing the Grey-headed Flying-fox as a Threatened Species in New South Wales*, edited by Peggy Eby and Daniel Lunney, 2002. Royal Zoological Society of New South Wales, Mosman, NSW.

Pallin, N. (2000). Ku-ring-gai Flying-fox Reserve: habitat restoration project, 15 years on. *Ecological Management and Restoration* 1:10-20.

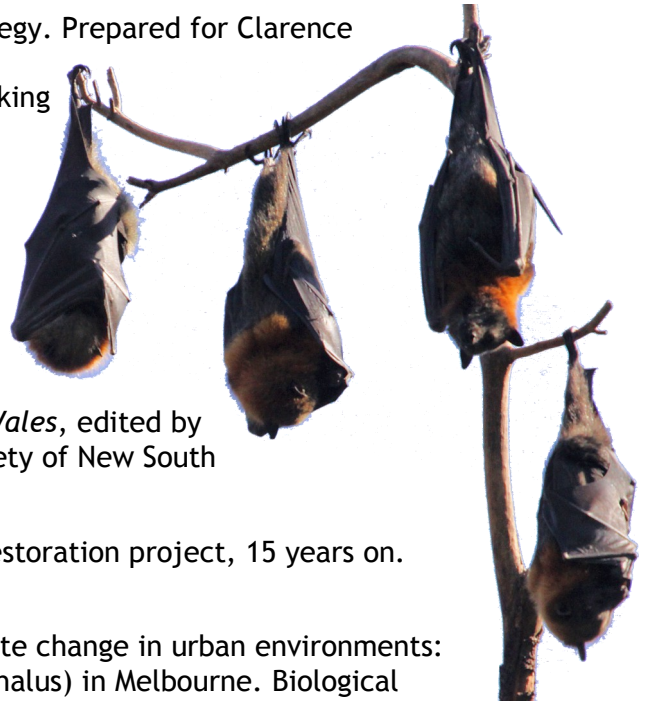
Parris, K. M. and Hazell, D.L. (2005) Biotic effects of climate change in urban environments: the case of the Grey-headed Flying-fox (*Pteropus poliocephalus*) in Melbourne. *Biological Conservation* 124:267-276.

Parry-Jones, K.A. and Augee, M.L. (2001). Factors affecting the occupation of a colony site in Sydney, New South Wales by the grey-headed flying-fox, *Pteropus poliocephalus* (Pteropodidae). *Austral Ecology* 26:47-55.

Roberts, B. (2005). Habitat characteristics of flying-fox camps in south-east Queensland. BSc (Hons) thesis. Griffith University, Brisbane.

Roberts, B.J., Kanowski, J. and Catterall, C. (2006). Ecology and Management of flying-fox Camps in an Urbanising Region, Issues in Tropical Forest Landscapes. Issue 5 June 2006, Rainforest CRC and Environmental Sciences, Griffith University. http://www.jcu.edu.au/rainforest/issues/ITFL_flyingfox.pdf

Snoyman, S. (2008). Micro-climate Preferences of the grey-headed flying-fox, *Pteropus poliocephalus* (Chiroptera: Pteropodidae), within the Sydney Region. BSc (Hons) thesis. Macquarie University, Sydney.



Appendix 1

Legislative and Policy Overview

An overview of the most relevant legislation related to management of flying-fox camp is provided below. This does not constitute legal advice. Camp managers and neighbours should consult with the relevant state agencies and local government and consider the need to obtain independent legal advice prior to making any decision that may affect compliance with legislation.

National

Environment Protection and Biodiversity Conservation Act 1999

grey-headed and spectacled flying-foxes are listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EPBC Act is the Australian Government's central piece of environmental legislation and is administered by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). Among other things, it provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as matters of national environmental significance.

There are eight matters of national environmental significance protected under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)

A person must not take an action that has, will have or is likely to have a *significant impact* on any of the matters of national environmental significance without approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the Minister).

A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

An action is likely to have a significant impact on a *vulnerable* species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

More information on significant impacts can be found in the Significant Impact Guidelines 1.1 - Matters of National Environmental Significance.

Types of actions which may impact on listed flying-foxes include (but are not restricted to):

- removal or modification of roost habitat (native, exotic or weed species),
- removal of foraging habitat,
- installation of closely-spaced power lines near habitat i.e. <1.5m apart.
- construction/infrastructure adjacent to colonies - both in the development and for potential long-term impacts, or
- activities which could disturb the camp particularly during the breeding cycle.

If you think the action you are proposing may or is likely to have a significant impact on a matter of national environmental significance, or if you are unsure, you should submit a referral.

Other Information Sources

- Referral Flowchart - <http://www.environment.gov.au/epbc/assessments/pubs/flow-chart.pdf>
- Draft spectacled flying-fox recovery plan is due for release shortly and will be available for download from <http://www.environment.gov.au/biodiversity/threatened/recovery.html>
- The recovery plan for the grey-headed flying-fox is currently in draft form: <http://www.environment.nsw.gov.au/resources/threatenedspecies/08214dnrpflyingfox.pdf>

DSEWPC is currently drafting a Policy Statement for managing flying-fox camps which will assist in defining what actions could be considered significant.

Things to keep in mind

- Engage with DSEWPC as early as possible.
- Offsets are generally applied on the basis that all options to avoid and mitigate on-site impacts have been applied prior to the consideration of off-site actions ie avoid, mitigate, offset. Refer to the draft Use of Environmental Offsets under the *Environment Protection and Biodiversity Conservation Act 1999* Discussion Paper.
- Generally, actions which impact on flying-fox colonies may only be undertaken during May, June and July each year, when there is no breeding activity, or when the animals are absent.

Note: The above does not constitute legal advice the Department of Sustainability, Environment, Water, Population and Communities and you should consider the need to obtain independent advice regarding the *Environment Protection and Biodiversity Conservation Act 1999* prior to making any decision that may affect your compliance with this legislation.

Queensland

In Queensland, the Department of Environment and Heritage Protection (DEHP) is responsible for administering the *Nature Conservation Act 1992* and associated Regulations. All four species of flying-fox likely to be encountered in Queensland are protected animals under the *Nature Conservation Act 1992* and are listed as 'least concern' wildlife under the *Nature Conservation (Wildlife) Regulation 2006*.

It is important to note that anyone who intends to undertake work or conduct activities within or near a flying-fox roost site familiarise themselves with the provisions of this legislative framework.

The following information is intended to provide people with an introduction of some of the provisions of the legislation that specifically relate to the protection of flying-foxes and their roosting sites. As there may be aspects of an activity that are not covered by these sections DEHP recommends that people should review all of the legislation that may be relevant to their proposed activity to ensure that they are compliant with Queensland legislation.

For information regarding the conservation and management of flying-foxes in Queensland and to seek further information and advice before undertaking any activity that may impact on flying-foxes and their roosts you can contact DEHP on 1300 130 372.

Nature Conservation Act 1992 (NCA)

Section 88C Restrictions relating to flying-foxes and flying-fox roosts

(1) A person must not destroy a flying-fox roost unless the person is an authorised person or the destruction is authorised under this Act.

Maximum penalty—1000 penalty units or 1 year's imprisonment.

(2) A person must not drive away, or attempt to drive away, a flying-fox from a flying-fox roost unless the person is an authorised person or the driving away is authorised under this Act.

Maximum penalty—1000 penalty units or 1 year's imprisonment.

(3) A person must not disturb a flying-fox in a flying-fox roost unless the person is an authorised person or the disturbance is authorised under this Act.

Maximum penalty—100 penalty units.

(4) This section does not apply if the flying-fox roost is in a protected area.

Note— For interfering with natural resources in protected areas, see section 62 (Restriction on taking etc. of cultural and natural resources of protected areas).

(5) Also, this section does not apply for an Aborigine or Torres Strait Islander taking, using or keeping a flying-fox under section 93.

(6) In this section—

breeding includes gestating.

drive away, a flying-fox from a flying-fox roost, means—

(a) cause the flying-fox to move away from the roost; or

(b) if the flying-fox has moved away from the roost, deter the flying-fox from returning to the roost.

Examples of ways of driving away a flying-fox includes—using sound, light, smoke, electric current or chemicals

Flying-fox means a protected animal of the genus *Pteropus*.

Flying-fox roost means a tree or other place where flying-foxes congregate from time to time for breeding or rearing their young.

Damage Mitigation Permits

If a person believes that their proposed actions may contravene the restrictions stated in section the NCA 1992 section 88C then they should apply for a Damage Mitigation Permit The following information highlights the relevant sections of the legislation that relate to the application and assessment process for these permits.

Relevant legislation: Nature Conservation (Wildlife Management) Regulation 2006

Section.181 Purpose of permit

(1) The purpose of a damage mitigation permit for animals is to allow a person to do an authorised act affecting a protected animal if the animal—

(a) is causing, or may cause, damage to property; or

(b) represents a threat to human health or wellbeing.

(2) In this section—

authorised act, affecting a protected animal, means any of the following—

(a) taking, keeping or using the animal;

(b) if the protected animal is a flying-fox—

(i) destroying a flying-fox roost used by the animal; or

(ii) driving away the animal from a flying-fox roost; or

(iii) disturbing the animal in a flying-fox roost.

Section.184 Restriction about purposes for which permit may be granted

(1) The chief executive may grant a damage mitigation permit only for 1 or both of the following purposes—

(a) to prevent damage or loss caused, or likely to be caused, by a protected animal;

(b) to prevent or minimise a threat, or potential threat, to human health and wellbeing caused by a protected animal.

Section.185 Restriction on grant or permit for damage or loss

The chief executive may grant a damage mitigation permit for damage or loss caused, or likely to be caused, by a protected animal only if the chief executive is satisfied that, among other considerations—

- (d) action under the permit will not adversely affect the survival of the animal in the wild; and
- (e) the proposed way of taking the animal is humane and not likely to cause unnecessary suffering to the animal.

Section.186 Restriction on grant of permit for threat to human health and wellbeing

The chief executive may grant a damage mitigation permit for a threat, or potential threat to human health and wellbeing caused by a protected animal only if the chief executive is satisfied –

- (b) action under the permit will not detrimentally affect the survival of the animal in the wild; and
- (c) the proposed way of taking the animal is humane and not likely to cause unnecessary suffering to the animal

When deciding an application for a relevant authority the chief executive must also consider a range of other relevant factors as listed in the following legislation;

Nature Conservation (Administration) Regulation 2006 Section 25

25 Considering application

(1) In considering an application for a relevant authority, the chief executive must have regard to each of the following—

- (a) the impact the activities that may be carried out under the authority may have on the conservation of the cultural or natural resources of a protected area or native wildlife;
- (b) the effect the grant of the authority will have on the fair and equitable access to nature, having regard to, in particular, the ecologically sustainable use of protected areas or wildlife;
- (c) any contribution the applicant proposes to make to the conservation of nature;
- (d) any relevant Australian or international code, instrument, protocol or standard or any relevant intergovernmental agreement;
- (e) the precautionary principle;
- (f) public health and safety;
- (g) the public interest;
- (h) for an application for a relevant authority other than a camping permit—whether the applicant is a suitable person to hold the authority, having regard to the matters mentioned in schedule 2;
- (i) for an application for a relevant authority for a national park (Cape York Peninsula Aboriginal land)—the indigenous management agreement for the protected

In circumstances where a proposed activity will or is likely to destroy a flying-fox roost (for example, remove some trees that are a roost for a flying-fox) then a Species Management Program (SMP) is required to be developed for approval by the chief executive. The SMP is required regardless of whether flying-foxes are present or not.

Relevant Legislation: *Nature Conservation (Wildlife Management) Regulation 2006.*

Section 332 Tampering with animal breeding place

(1) A person must not, without a reasonable excuse, tamper with an animal breeding place that is being used by a protected animal to incubate or rear the animal's offspring.

Maximum penalty—165 penalty units.

(2) For subsection (1), an animal breeding place is being used by a protected animal to incubate or rear the animal's offspring if—

- (a) the animal is preparing, or has prepared, the place for incubating or rearing the animal's offspring; or
- (b) the animal is breeding, or is about to breed, and is physically occupying the place; or
- (c) the animal and the animal's offspring are physically occupying the place, even if the occupation is only periodical; or
- (d) the animal has used the place to incubate or rear the animal's offspring and is of a species generally known to return to the same place to incubate or rear offspring in each breeding season for the animal.

(3) It is a reasonable excuse for a person to tamper with the breeding place if—

- (a) the tampering happened in the course of a lawful activity that was not directed towards the tampering; and
- (b) the tampering could not have been reasonably avoided.

(4) Also, subsection (1) does not apply to a person removing or otherwise tampering with the breeding place if—

- (a) the removal or tampering is part of an approved species management program for animals of the same species; or
- (b) the person holds a damage mitigation permit for the animal and the permit authorises the removal or tampering.

(5) In this section—

approved species management program, for a species of animal, means a program about managing the population and habitat of the species of animal that is approved by the chief executive.

tamper, with an animal breeding place, means damage, destroy, mark, move or dig up the breeding place.

Under Queensland legislation, authorisation to remove protected plants may be required.

Relevant Legislation: *Nature Conservation (Wildlife Management) Regulation 2006*.

Section 276 Taking protected plants authorised

(1) The holder of a clearing permit, or a relevant person for the holder, may take protected plants, by clearing the plants, from the place stated on the permit as a place from where the plants may be taken.

Relevant legislation: Protected Plants Conservation Plan

Section 29 Restrictions on grant of clearing permit

(1) The chief executive may grant a clearing permit for taking protected plants only if the chief executive is satisfied—

- (a) the applicant is the landholder, or has the approval of the landholder, of the land on which the plants are located; and
- (b) the taking will not adversely affect the survival in the wild of the plant; and
- (c) for a plant mentioned in section 11(1)(a), (b) or (c)—exceptional circumstances apply to its taking.

Further Information

DEHP information relating to flying-foxes — <http://www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/index.html>

DEHP wildlife permits and licences page — <http://www.ehp.qld.gov.au/wildlife/permits-licences/index.html>

Queensland legislation — http://www.legislation.qld.gov.au/Acts_SLs/Acts_SL.htm

New South Wales (NSW)

The grey-headed flying-fox is listed as Vulnerable under the *Threatened Species Conservation Act 1995*. In addition, many flying-fox camps are located in endangered ecological communities also protected under this legislation.

Other legislation likely to be of relevance to activities in and around flying-fox camps in NSW includes:

- *Environmental Planning and Assessment Act 1979*; and
- *National Parks and Wildlife Act 1974*.

It is the proponent's responsibility to find out whether they need approval for their activities.

Environmental Planning and Assessment Act 1979 (EPA Act)

Generally camp modification activities will not trigger a requirement for development consent under Part 4 of the EPA Act, however, Councils may have the option of assessing and determining proposed works under Part 5 of the EPA Act where it relates to Council's own land.

National Parks and Wildlife Act 1974 (NPW Act)

Applicants have the option of applying for a Scientific Licence under s132(C) of the NPW Act to carry out conservation activities. This can be obtained through contacting the NSW Office of Environment and Heritage (OEH), Wildlife Licensing and Management unit on **(02) 9585 6406** or email

wildlife.licensing@environment.nsw.gov.au), or going to <http://www.environment.nsw.gov.au/wildlifelicences/ScientificResearchLicences.htm>

Threatened Species Conservation Act 1995 (TSC Act)

Alternatively and more commonly, applicants can apply for a Threatened Species Licence under s91 the TSC Act. In assessing the application, OEH will evaluate whether the proposal will have a significant impact on threatened species, populations or communities and their habitats according to set criteria. Based on that assessment a decision is then made to either approve as is; approve with conditions; refuse; or require further assessment if there is likely to be a significant impact to threatened species associated with the work (Species Impact Statement). Conservation focussed camp management proposals are typically approved with conditions. Applications and further information is available at <http://www.environment.nsw.gov.au/threatenedspecies/S91TscaLicenceForm.htm>. Note a processing fee applies.

Benefits of obtaining a license:

Whilst it is not strictly a requirement to obtain an approval, licence or other authorisation to do camp management works (and there are a number of situations where exemptions apply), there are a number of benefits to doing so:

- It provides those undertaking the work with a valid legal defence in the event of any allegation that threatened species/populations or communities or their habitat have been harmed, picked or damaged as a result of the work being done, provided the works are carried out according to the proposal and any relevant conditions applied.
- It also provides the applicant with a framework for planning and evaluating their proposed work, including thinking about possible effects of the action - planned or unplanned - as well as defining appropriate safeguards that will be put in place to limit the risk of negative impacts to biodiversity values. Submitting the proposal for assessment will also lend a ‘fresh eye’ to the proposal that can help ensure important issues are not missed and for applicants to become informed of any “best management practice” guidelines that may be relevant to the work.

Appropriate paperwork behind a proposal can assist in obtaining funding to carry out the planned works e.g. NSW Environment Trust.

All s91 applications and the determination made for each proposal is included on a public register on the OEH website. This can be referred to by anyone who would like to view the authorisation for the work and what is actually proposed to be done which can assist in responding to inquiries.

Considerations in developing a proposal:

- It is recommended to make contact with OEH before completing an application for advice as to whether an application is worthwhile for the particular work proposed and to talk about the proposal generally. Making contact early can make completing the application a lot easier, speed assessment and make planning works more straightforward.
- Plan to allow enough time for the license to be processed - this can be best ascertained by contacting the relevant office that will be handling your application.
- Licensing for these kinds of activities is not intended to be onerous for applicants - the legislation is designed to capture activities that will have a significant negative impact on threatened biodiversity.

If in doubt, contact the “Environment Protection and Regulation” section at your local OEH office. A list of offices is available at: <http://www.environment.nsw.gov.au/contact/> or you can simply contact our Environment Line on telephone 131555.

Appendix 2

Forum Attendees

Marcia Abraham
Janette Barnsley
Ben Barton, SEQ Catchments Ltd
Rochelle Basham, Eco Logical Australia Pty Ltd
Carol Booth
Holly Bryant, NatureCall
Lonie Budd, Noah's Ark Wildlife Coalition
Shaun Burke, Department of Sustainability and Environment (Vic)
Mal Cadioli, Brisbane City Council
Amber Cameron, Department of Environment and Resource Management (Qld)
Cath Cleary, Brisbane City Council
Melissa Cooper, Brisbane City Council
Nick Corkish, Department of Environment, Climate Change and Water (NSW)
Kristen Dangerfield, Brisbane City Council
Jenny Davis, Redland City Council
Kristin den Exter, Southern Cross University
Michael Devery, Department of Environment and Resource Management (Qld)
Kimberley Duncan, Sunshine Coast Regional Council
Naomi Dwyer, Department of Environment, Water, Heritage and the Arts (Aust)
Peggy Eby
Andrew Evans, Moreton Bay Regional Council
Hume Field, Biosecurity Queensland
Tanya Fountain, Tweed Shire Council
Wendy Geoghegan, Department of Environment, Water, Heritage and the Arts (Aust)
Terry Genever, Cairns Regional Council
David Goldney, Cenwest Environmental Services (rep. Orange City Council)
Liz Gould, SEQ Catchments Ltd
Nigel Greenup, Gold Coast City Council
Susy Hale, NatureCall
Craig Hardie, Brisbane City Council
Doreen Harwood, Tweed Shire Council
Jeff Hayter, Queensland Parks and Wildlife Service
Wendy Heath, Moreton Bay Regional Council
John Hueston, Department of Environment and Resource Management (Qld)
Sally Jacka, Tweed Shire Council
Bob James, Bat Conservation and Rescue Queensland
Jenny James, Bat Conservation and Rescue Queensland
Conor Jenkins, Sunshine Coast Regional Council
Robyn Jones, Brisbane City Council
Mark Kingston, Tweed Shire Council
Jenny Lang, Bat Conservation and Rescue Queensland
Jenny Leask, Brisbane City Council
Rachel Lyons, Burnett Mary Regional Group
Kelli Manning, Sunshine Coast Regional Council
Jeff McKee, Ecosure
Amanda McLaughlin, Biosecurity Queensland
Andrew McLoughlin, Lockyer Valley Regional Council
Glen Miechel, Sunshine Coast Regional Council
Glen Millar, Moreton Bay Regional Council
Greg O'Neill, Department of Environment and Resource Management (Qld)
Nancy Pallin, Ku-Ring Gai Bat Conservation Society
Billie Roberts, Griffith University
Ilona Roberts, Tweed Valley Wildlife Carers

Tim Robson, Gold Coast City Council
Kelly Roche, Department of Environment, Climate Change and Water (NSW)
Lib Ruytenberg, WIRES Northern Rivers NSW
Paul Sanderson, Brisbane City Council
Louise Saunders, Bat Conservation and Rescue Queensland
Phil Shaw, Ecosure
Veronica Silver, GeoLINK
Abigail Smith, Department of Sustainability and Environment (Vic)
Mary Starky, Department of Environment and Resource Management (Qld)
Greg Strain, Sunshine Coast Regional Council
Jamie Taylor, Department of Environment and Resource Management (Qld)
Leanne Thomas, Department of Environment and Resource Management (Qld)
Jo Towsey, University of Queensland
Angus Underwood, Byron Shire Council
Marilyn Varvaro, Noah's Ark Wildlife Coalition
Phil Watts, Gold Coast City Council
Russell Wild, Cairns City Council
Trish Wimberley, Australian Bat Clinic

