ecosure

Ingham flying-fox roost management advice

Report
April 2015

HINCHINBROOK SHIRE COUNCIL

ecology / vegetation / wildlife / aquatic ecology / GIS

Contents

Acronyms

ABLV	Australian bat lyssavirus
BFF	Black flying-fox
COP	Code of practice
DoE	Commonwealth Department of the Environment
EHP	Department of Environment and Heritage Protection
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EVNT	Endangered, vulnerable or near threatened
FFMP	Flying-fox management plan
FFRMP	Flying-fox roost management permit
GHFF	Grey-headed flying-fox
HeV	Hendra virus
HSC	Hinchinbrook Shire Council
LGA	Local government area
LRFF	Little-red flying-fox
NC Act	*Nature Conservation Act 1992*
SoMI	Statement of Management Intent
UFFMA	Urban Flying-fox Management Area
VM Act	Queensland *Vegetation Management Act 1999*

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1 Background

Flying-foxes have reportedly been roosting at the Ingham Memorial Gardens within the township of Ingham for a number of years (P Ingerson 30 March 2015, pers. comm.). In the past, a population of several thousand black flying-foxes (*Pteropus alecto*) along with small numbers of grey-headed flying foxes (*Pteropus poliocephalus*) and spectacled flying-foxes (*Pteropus conspicillatus*) have been known to roost in the park. Little-red flying-foxes (*Pteropus scapulatus*) frequent the area in larger numbers. The fact that all four species of flying-fox are known to visit this roost, with two of these being listed as vulnerable at a state, national and international level, makes it one of the most unique roosts in Australia.

In mid-February 2015 there was a large influx of little-red flying-foxes (LRFF) which, based on density and duration of the fly-out, increased the roost population to an estimated 500,000. Hinchinbrook Shire Council (HSC) subsequently contacted Ecosure to discuss the best approach to managing impacts associated with the roost.

Issues associated with the roost include:

- reduced amenity for nearby residents, businesses and park users
- community fear of disease
- damage to vegetation in the gardens.

Ecosure assessed the roost in March 2015, by which time the LRFF had left the roost, leaving approximately 30,000 black flying-foxes (BFF) and an estimated 200 grey-headed flying-foxes (GHFF) (Figure 1). No spectacled flying-foxes (SFF) were identified at the time of the assessment, despite two thorough visual assessments of the roost on two separate days from all angles using binoculars. Data collected between 2012 and 2014 indicated a category 1 SFF population, which is between 1 and 999 individuals (DoE 2015). Information provided during the assessment by Paula Ingerson from HSC indicated numbers are generally around 200-300 individuals (pers. Comm March 2015). It is therefore assumed there is a high chance a small population is present.

No previous attempts have been made to manage the roost. This report provides HSC with possible management actions that may be available to them in the future and associated costs.

Flying-foxes are a critical element of ecological biodiversity and are protected in Queensland under the *Nature Conservation Act 1992* (NC Act). Long range seed dispersal by flying-foxes is probably the most critical component for the ongoing persistence of plant populations (Westcott et al. 2008), and the significance of this is magnified when considered in the context of large-scale habitat loss and fragmentation. For this reason they are also critical to key economic activities such as forestry and tourism.

Flying-foxes appear to be more frequently roosting and foraging in urban areas because of habitat clearing elsewhere, human encroachment and drought, combined with the opportunities presented by year-round food availability from native and exotic species in urban

areas. In urban settings the noise, smell and excrement originating from these roosts can cause significant concern for nearby residents and businesses.

Figure 1 Grey-headed flying-fox

2 Legislation and policy framework

2.1 Local

Local government agencies are required to prepare planning schemes consistent with Queensland Planning Provisions under the *Sustainable Planning Act 2009*.

Planning schemes enable an LGA to manage growth and change in their local government area through land use and administrative definitions, zones, overlays, infrastructure planning provisions, assessment codes and other administrative matters. A planning scheme identifies the kind of development requiring approval, as well as areas constrained by their environmental value.

There are no specific requirements under the Hinchinbrook Shire Planning Scheme 2005 for flying-fox management or restrictions on trimming or removal of vegetation. Consideration should be given to ensuring compliance with the open space and recreation zone code (HSC 2012).

2.2 Queensland

2.2.1 Nature Conservation Act 1992

EHP administers the NC Act and is responsible for the management and conservation of flying-foxes in Queensland. Flying-foxes and their habitat are protected under the NC Act.

An unauthorised person may face significant financial penalty or one year imprisonment if they attempt to destroy a flying-fox roost, or drive flying-foxes away from a roost. Significant penalties may also apply for unauthorised disturbance of a flying-fox roost.

Council-managed land

On 29 November 2013, the Queensland Government revised its approach for managing flying-foxes. This included the release of two codes of practice that provide the public and local governments authority to undertake particular activities to manage flying-foxes. It is important to note that this does not obligate local government to implement those revised approaches.

The latest reform implemented in 2013 allows management of flying-fox roosts, including:

- The ‘as-of-right’ authority for local governments to manage and/or disperse flying-fox roosts in Urban Flying-fox Management Areas (UFFMA) in accordance with a code of practice (COP) without the need for a permit under the NC Act. Any other landholder wishing to undertake management of a flying-fox roost on their land must still independently apply to EHP for a Flying-fox Roost Management Permit, as must Council for activities outside the UFFMA.

- The 'as-of-right' authority for all persons (including residents) to undertake certain low impact management activities (e.g. weeding, mulching, mowing and minor tree trimming) within and outside the UFFMA in accordance with a COP.

UFFMA mapping is provided in Appendix 1.

The COP – *Ecologically sustainable management of flying-fox roosts* (EHP 2013a) sets out how local government may manage roosts within the UFFMA (defined by EHP). Specifically, the code outlines how councils may:

- destroy a flying-fox roost
- drive away, or attempt to drive away, a flying-fox from a flying-fox roost, and
- disturb a flying-fox in a flying-fox roost.

Proposed management actions undertaken by local governments that do not comply with the codes may only be conducted under the approval of a Flying-fox Roost Management Permit (FFRMP) (issued by EHP).

Without an EHP-approved Flying-fox Management Plan (FFMP), local government requires a FFRMP for roosts outside the UFFMAs. However following the development of and EHP endorsement of an FFMP, management activities for roosts outside the UFFMAs will be permitted without an FFRMP for a period of three years.

Council must notify EHP at least two business days prior to any roost management activity using the form on the EHP website.

Private freehold land

The COP– *low impact activities affecting flying-fox roosts* (EHP 2013b) sets out how a private landowner may undertake low impact activities at a flying-fox roost anywhere in the State of Queensland in accordance with section 41B of the Nature Conservation (Wildlife Management) Regulation 2006. Operating outside of the COP is not authorised and may have legal consequences.

Under this code, low impact activities are mulching, mowing or weeding under or near roost trees, and/or minor trimming of roost trees, where the activities are not directed at destroying a flying-fox roost, driving away, or attempting to drive away, a flying-fox from a flying-fox roost, or disturbing a flying-fox in a flying-fox roost.

The code outlines the following restrictions for activities undertaken by private landowners.

- No roost tree may be trimmed when there are flying-foxes in that part of the tree being trimmed, or when flying-foxes are near the tree and likely to be harmed as a result of the trimming.
- Any trimming of roost trees must be limited to 10% of the total canopy occupied by the roost (not 10% of the whole tree's canopy).

- Low impact activities must immediately cease, and EHP be immediately notified, if a flying-fox appears to have been killed or injured.
- Where low impact activities are required to be undertaken during the day time, works must immediately cease and EHP be immediately notified if 30% or more of the adult flying-foxes leave the roost for five minutes or more.

Where a private landholder wishes to manage a roost in any way not specifically outlined in the low impact COP, they must apply to EHP for a FFRMP.

It is important to note that neither code provides exemptions to other legislation and provisions that are likely to be relevant to flying-fox management activities, such as the Queensland *Vegetation Management Act 1999* (VM Act), *Fisheries Act 1994*, the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and various state and local planning provisions. They also do not provide exemptions for all vegetation under the NC Act (see below).

Vegetation

All plants that are indigenous to Australia are protected in Queensland under the NC Act. Prior to any clearing of protected plants, a person must check the flora survey trigger map to determine if the clearing is within a high risk area for the occurrence of endangered, vulnerable or near threatened (EVNT) plants:

- In a high risk area, a flora survey must be undertaken and a clearing permit may be required for clearing EVNT plants and their supporting habitat.
- If a flora survey identifies that EVNT plants are not present or can be avoided by 100 m, the clearing activity may be exempt from a permit. An exempt clearing notification form is required.
- In an area other than a high risk area, a clearing permit is only required where a person is, or becomes, aware that EVNT plants are present.
- Clearing of least concern plants is exempt from requiring a clearing permit within a low risk area.

2.2.2 Vegetation Management Act 1999

The clearing of native vegetation in Queensland is regulated by the VM Act, the *Sustainable Planning Act 2009* and associated policies and codes.

The type of clearing activity allowed, and how it is regulated, depends on:

- the type of vegetation (as indicated on the regulated vegetation management map and supporting maps)
- the tenure of the land (e.g. freehold or Indigenous land)
- the location, extent and purpose of the proposed clearing
- who is proposing to do the clearing (e.g. state government body, landholder).

Depending on these factors, clearing activities will either:

- be exempt from any approval or notification process
- require notification and adherence to a self-assessable code
- require notification and adherence to an area management plan
- require a development approval.

VM Act exemptions allow native vegetation to be cleared for a range of routine property management activities without the need for a development approval or notification. A number of VM Act exemptions may apply to clearing vegetation that is flying-fox roosting or foraging habitat. However, specific advice should be obtained from DNRM for each proposed vegetation clearing activity.

No explicit VM Act exemptions for clearing flying-fox roost or foraging vegetation were in place as at April 2015.

2.3 Commonwealth

The Commonwealth's EPBC Act provides protection for the environment, specifically matters of national significance. A referral to the Commonwealth DoE is required under the EPBC Act for any action that is likely to significantly impact on a matter of national environmental significance (MNES).

MNES under the EPBC Act are:

- world heritage sites
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- nuclear actions.

The GHFF and SFF are listed as nationally vulnerable under the EPBC Act.

As per the self-assessable criteria in the Significant Impact Guidelines 1.1 (DoE 2013) 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 or 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.

Previously critical GHFF and SFF habitat (where management may require referral to the DoE) was based on criteria in the GHFF and SFF draft national recovery plan (DECC 2009; DERM 2010). However, recently guidelines for camp management have been released as a draft EPBC Act Policy Statement (DoE 2014). These guidelines define a nationally important GHFF camp as one that has either:

i. contained ≥ 10,000 GHFF in more than one year in the last 10 years, or
ii. been occupied by more than 2,500 GHFF permanently or seasonally every year for the last 10 years.

Nationally important SFF camps have been defined as having either:

i. contained ≥ 16,000 SFF in more than one year in the last 10 years, or
ii. been occupied by SFF in at least 50% of the surveys over the last 10 years.

As confirmed by DoE (DoE pers. comm. 18th March 2015):

- these guidelines are now in force and will remain the guide as to whether referral is required for management at a GHFF or SFF roost until the policy is finalised or otherwise superseded
- a referral is not required for management at any roost (including those that meet nationally important criteria) under the draft policy, provided that best practice mitigation standards detailed in the policy (or in state standards with the same intent) are followed.

2.4 International agreements

All flying-fox species are listed in Appendix II of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* as species that may become threatened with extinction unless international trade is not closely controlled.

The GHFF is listed as vulnerable on the International Union for Conservation of Nature and Resources (IUCN) Red List because of continuing population decline, estimated at more than 30% over the last three generations (IUCN 2013).

3 Management options

The following section outlines management options relevant for this roost that may considered by HSC. As discussed in Section 2, the COPs do not provide exemptions under all sections of the NC Act or other relevant legislation. As such, HSC will need to consider all ecological and cultural values of the site prior to implementing any management activity that may impact on these values.

A detailed plan for any roost management activity is also required to ensure OH&S and animal welfare is properly considered.

3.1 In-situ management

In-situ management aims to mitigate impacts associated with a flying-fox roost, while allowing flying-foxes to continue using the roost. Managing flying-foxes at the site they have chosen to roost in is generally preferred due to the risks associated with dispersal (as detailed in Section 3.2).

Any in-situ management will need to be undertaken in accordance with the COP's. A statement of management intent (SOMI) may need to be developed prior to any management being undertaken. The State government may require the development of a SOMI under the NC Act. The aim of a SOMI is to provide a mechanism for Council's to communicate their intentions for management of both existing and new flying-fox roosts within the UFFMA to the community.

3.1.1 Education

To appease community fears and misconceptions about risk, and increase appreciation of flying-foxes, educational materials can be developed. Providing educational materials should always be a first response when community concerns are raised. Education should also be incorporated into any further management approach.

A roost education campaign for Ingham may include:

- Interpretative signage at the park. This site is an ideal location to utilise signage to communicate educational messages to park users. Interpretive displays could include art work completed by the community to encourage a sense of ownership and improve awareness and appreciation of flying-foxes. Several signs could be installed along the walking track to the south of the roost.
- Community meetings and school based educational packages. In Ecosure's experience, public forums are one of the best ways to communicate information relating to flying-foxes and management.
- Pamphlets or brochures for distribution within the community with tips for living near flying-foxes.

- Website page managed by Council with relevant information on flying-fox management.

HSC could engage Ecosure to develop pamphlet/brochure or website content as well as speak at a community meeting and with local schools for approximately $8,000.00. Costs of on-going educational materials would be <1$,000.00/year.

3.1.2 Creating buffers

Buffers can be created using a number of different methods including vegetation removal, installation of permanent/semi-permanent deterrents, 'nudging' flying-foxes from conflict areas using low intensity disturbance, physical barriers or a combination of these.

A combination of the following buffers could be trialled at this site:

- Vegetation modification/removal. Two to three trees at the western end of the roost site could be removed to create approximately a 40 m buffer between the commercial properties on the Bruce Highway that back onto the park area and the roost, along with a general clean-up of ground vegetation to the western end. This area would likely require minimal maintenance beyond mowing. A cost estimate for Ecosure to use vaccinated people to complete this work has been provided below.
- Physical barriers. Planting species that are not attractive to flying-foxes along the northern boundary would create a buffer between the roost and the closest residential properties. There is a risk of flying-foxes moving into these trees if there is another significant in-flux on LRFF in the future. Acoustic fencing could also be used along this boundary to minimize impacts to neighboring properties. A cost estimate from Wallmark has been provided below.
- Permanent or semi-permanent deterrents. Many deterrents have been trialled in the past to deter flying-foxes from a designated buffer area, however the following are examples we believe are worth further investigation. Python excrement has been locally effective in the past (GeoLink 2012) however poses logistical issues relating to resources. Visual deterrents such as helium filled balloons (Ecosure personal experience), plastic bags or fluro vests (GeoLink 2012) placed strategically into trees within the designated buffer area can be effective. Noise emitters emitting random, varied and unexpected noises can be effective, however can be disruptive to local residents. Canopy mounted water sprinklers have been highly effective however may be difficult to install and cost prohibitive.
- Nudging could be undertaken in conjunction with the above deterrents. It would involve using noise to encourage the flying-foxes out of designated buffer areas. It would need to be done during daylight hours to avoid inadvertent dispersal and would therefore require additional approval from EHP.

HSC could engage Ecosure to have a wildlife biologist and vaccinated chainsaw operators undertake vegetation removal and modification at the western end of the roost to create a 40m buffer for approximately $17,000. Wallmark provided a quote to supply and install a 2 m high and 100 m long acoustic fence for approximately $25,000 ex GST (extra travel costs may apply). Council may know of a local supplier who would be more cost effective.

3.1.3 Modifying properties.

Property modification can be used to reduce smell, noise and general amenity impacts on properties adjoining flying-fox roosts. These might include installing screening or densely planting shrubs along the boundary, double glazing windows, installing sound reducing insulation, car ports or covered areas to mitigate faecal drop during fly-in and fly-out and air conditioning.

Council may wish to pursue providing some assistance to near-by residents.

3.2 Dispersal

There are a range of potential risks that are greatly increased with active dispersal (compared with in situ management above). These include:

- splintering the roost into other locations that are equally or more problematic. Figure 2 below demonstrates areas within the township of Ingham that are likely to be suitable habitat for flying-foxes. The majority of these areas are within 100 m of residential properties and two are within 100 m of schools or kindergartens
- four different dispersal approaches are required for the different response to dispersal by the four different species potentially present
- impact on animal welfare and flying-fox conservation of nationally vulnerable species
- increased aircraft strike risk associated with changed flying-fox movement patterns
- impact on ecological and amenity value of roost habitat requiring modification
- effects on the flying-fox population, including disease status and associated public health risk
- impacts to residents associated with ongoing dispersal attempts
- excessive initial and/or ongoing resource and financial investment
- negative public perception
- unsuccessful management requiring multiple attempts, which may exacerbate all of the above.

Figure 2: Potential habitat areas

Potential habitat

Hinchinbrook Shire Council

Ingham flying-fox roost management advice

ecosure

Job number: RW129
Revision: 0
Author: MED
Date: 08/04/2015

0 100 200 400
Metres

GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

RW129_MP_Fig2_PotentialHabitat
A4

Successful dispersals generally require either:

i. substantial vegetation removal/modification, or

ii. sustained disturbance at the site and intensive monitoring, with subsequent additional dispersals from splinter roosts that are considered unsuitable, or a mixture of both.

Each of the above dispersal approaches are very costly, require ongoing commitment and maintenance, are generally not entirely successful and rarely result in desirable outcomes for all stakeholders (see Appendix 1). Dispersal also often leads to flying-fox stress, injuries or fatalities, and may increase human health risk, nuisance issues, or human/flying-fox conflict at other sites.

It is important to note that flying-foxes are likely to show a high level of fidelity to long term roost sites. This makes dispersal considerably more difficult, time consuming, and costly (and less likely to succeed in the long-run) compared with a newly established roost, and another reason in situ management is preferable for this roost. Although dispersal may move them to the alternative site in the short term, it is likely they will return to the original roost in subsequent years.

A detailed site-specific plan for any additional management activity (especially dispersal if required) should be developed by an appropriate person with a comprehensive understanding of flying-fox behaviour and management. This will ensure appropriate measures to protect human safety and animal welfare, and assist managing risks associated with dispersal (i.e. splintering).

An alternative roosting site would need to be negotiated upon between HSC and Ecosure that would provide suitable habitat for the flying-foxes (appropriate species, density and canopy in close proximity to a water source) as well as be suitable for the community. A community consultation meeting would be required prior to dispersal commencing to ensure residents are aware of the likelihood of flying-foxes roosting within other unsuitable areas for short periods of time. They would also be informed of the likely disturbance within the township for as long as the dispersal is under way.

Given the likelihood of all four species being present, a detailed dispersal plan would need to be developed that accounts for the differing response of all four species to dispersal activities. Approvals would also need to be obtained from both the State and federal government in order to undertake the dispersal. Dispersal team sizes vary depending on the size of the roost and species present. Due to the nature of this roost, and the likely requirement to adapt the dispersal methods depending on the reactions of the different species, a team of 15 experienced people would be recommended.

It is difficult to estimate the amount of time it would take to successfully complete the dispersal. It is important to note that it could take several weeks and potentially several attempts to dispersal the flying-foxes to an acceptable alternative site. Dispersal costs are likely to range from between $100,000 to over $250,000.

4 Recommendations

Table 1 Options analysis

Approach	Option	Social	Environmental	Financial*	Potential for impact at other sites (unknown roosts and unknown locations)	Recommended (yes/no)
In-situ management	Education	Minimal impact to conservation values or park users. Will assist in managing impact, can be used in conjunction with other methods.	Minimal impact to conservation values or vegetation. Positive conservation outcome for flying-foxes at this location and in general.	Limited resource allocation required. Initial financial input and minimal maintenance annually thereafter.	**Low – no intention to disperse.**	Yes
	Creating buffers/physical barriers	Impacts to near-by properties reduced through 40 m buffer.	Positive outcome for flying-foxes and other ecological values.	Moderate resource allocation required. Initial financial input of approx. $17,000 for 40 m buffer to the west. Physical barriers to the north, approx. $25,000 for acoustic fencing.	**Low – no intention to disperse**	Yes – 40m buffer to the west and consideration made to physical barriers to the north.
	Modifying properties	Impacts to near-by properties reduced.	Positive outcome for flying-foxes with retained roost and no further management required within the roost.	Variable but generally low to moderate initial costs and low maintenance costs (i.e. $500-$5,000/property depending on the type of modification). Council may investigate opportunities for assistance grants.	**NIL**	Yes.
Dispersal		Many properties around town may be impacted due to relocation of flying-foxes to other areas of potential habitat, potentially in high conflict zones (near schools/kindergartens). Impacts to residents through disruption in early hours of morning, possible for several weeks and possibly intermittently for years.	Most likely to result in poor welfare outcomes for flying-foxes.	Usually high initial costs (>$150,000) and moderate to high maintenance costs (>$50,000/year). Also a high level of uncertainty means the inability to effectively budget.	**High**	Not recommended.

The issues associated with this roost appear to be amenity-based rather than risk-based. Ingham is an important roost, being one of the only sites known to provide habitat for all four species of flying-fox. We believe this presents HSC with a great opportunity to educate the community on the actual health risks from flying-foxes and on the importance of flying-foxes to our natural environments. Their current location impacts on few residential or commercial properties. Impacts to those within close proximity can be managed through methods mentioned below.

Although the park is open to public use, it is unlikely that park users will have negative interactions with flying-foxes as there are no designated paths within the roost site. For these reasons, along with risks associated with dispersal as detailed above, it is recommended that management be in-situ mitigation. In-situ management has been recommended due to the limited impact to residents and flying-foxes and cost effectiveness for council.

4.1 In-situ management

Mitigation measures that should be considered to manage the roost in situ include:

- Creating buffers between roost habitat and high conflict areas (i.e. businesses or residences opposite some areas of the park). Roost habitat in these areas may be removed/trimmed to reduce attractiveness to flying-foxes. Physical barriers are recommended to reduce noise impacts on near-by residential properties.
- Providing and/or enhancing habitat in designated areas of the park will assist preventing spill over into adjacent properties during large influxes of little red flying-foxes.
- Educating the community on living near flying-foxes as well as vegetation management measures to reduce the attractiveness of properties to roosting and foraging flying-foxes and providing information on noise attenuation measures.
- Educating the community and park visitors on the actual disease risk (see Qld Health). This could be through interpretative signage in the park, community meetings and school visits, brochure's and web pages

4.2 Dispersal

With so many potential habitat areas around the township of Ingham (Figure 1), there is a high risk that dispersal could result in flying-foxes roosting within close proximity to high density residential areas. There is also a risk of flying-foxes roosting within 100 m of sensitive areas such as schools and kindergartens.

If mitigation is not considered appropriate, a detailed dispersal plan should be developed by a wildlife management specialist with experience in successful flying-fox dispersal and a comprehensive understanding of flying-fox behaviour. This plan should include:

- feasibility assessment of alternative sites, including selecting sites that can be used in a staged relocation, and steps to improve these as required
- a strategic and staged management approach to improve the likelihood of relocating flying-foxes to a desirable location
- appropriate human safety measures
- a holistic approach to management, including deterring flying-foxes from the area by managing vegetation and water sources
- suitable dispersal timing and methods to increase the likelihood of success, ensure human risk is not elevated (i.e. from dropped pups, injured adults etc) and animal welfare.

Ecosure has managed nine flying-fox dispersals (and a number more in-situ management programs). Two recent dispersals at Duaringa and Middlemount were large colonies of little red flying-foxes. We worked with Council to select suitable alternative sites, and planned a route to move the colony to these pre-determined locations. We successfully directed little red flying-foxes to the desired locations within two weeks of dispersal through the strategic use of mobile smoke machines and placement of experienced personnel with a range of other tools.

Our success has been based on our ability to rapidly adapt the dispersal approach based on a good understanding of flying-fox behaviour. This, along with ensuring flying-fox health and wellbeing and effective community consultation, is critical to a successful dispersal.

4.3 Long-term management

Ecosure has assisted a number of Councils in developing flying-fox management plans (FFMP) to assist in the long-term management of flying-fox roosts within a local government area. The aim of the FFMP is to outline options to appropriately manage and mitigate the health and amenity issues associated with identified flying-fox camps in the region in line with the NC Act and EPBC Act and recent codes of practice regarding management outside of urban flying-fox management areas (UFFMA). Operating outside of the Hinchinbrook UFFMA's without an FFMP is not authorised and may be a breach of the NC Act*, Animal Care and Protection Act 2001* and the EPBC Act.

It is recommended that HSC consider this option, to help inform future management and resourcing requirements in relation to the areas flying-fox roosts. Ecosure can develop an FFMP for HSC for approximately $28,000.

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Appendix 1 Summary of previous dispersal attempts[1]

Location	Species	FF population estimate at time of dispersal	Method	Did the animals leave the local area?	Did the local population reduce in size?	How far did they move?	Were new roosts formed (number of new roosts if known)?	Number of separate actions	Cost (if known)	Was conflict resolved at the original site?	Was conflict resolved for the community?
Barcaldine, Qld	R	>50,000	VN	no	no	≈2 km	yes (1)	trees in township felled		yes	no
Batchelor, NT	B	200	BNS	no	no	<400 m	yes (1)	2		yes	yes
Boyne Island, Qld	BR	25,000	LNS	no	no	<500 m	yes (2)	3		yes	no
Bundall, Qld[2]	GB	1580	V	uk	no	uk, but 7 roosts were within 5 km	no	1	$250,000	yes	uk
Charters Towers, Qld	RB	variable	HLNPOW	no	no	200 m	no (returned to original site)	repeated since 2000	>$500,000	no	no
Dallis Park, NSW	BG	28,000	V	no	yes	300 m	yes (1)	2		yes	no
Duaringa, Qld[3]	RB	>280,000	VNFOS	No	no	2 km	No	6 over 6 year period	Up to $150,000/year	yes	Yes although unlikely to last
Gayndah, Qld	RB	200,000	VN	no	no	600 m	yes	3 actions, repeated		yes	no
Maclean, NSW	BGR	20,000	NS	no	no	350 m	yes (7)	>23	>$400,000 and ongoing	no	o

1 Source: Roberts and Eby 2013, *Review of past flying-fox dispersal actions between 1990-2013.*

2 Bundall information amended from Roberts and Eby (2013) based on Ecosure's direct involvement and understanding of roost management activities and outcomes.

3 Duaringa information amended from Roberts and Eby (2013) based on Ecosure's direct involvement and understanding of roost management activities and outcomes.

Location	Species	FF population estimate at time of dispersal	Method	Did the animals leave the local area?	Did the local population reduce in size?	How far did they move?	Were new roosts formed (number of new roosts if known)?	Number of separate actions	Cost (if known)	Was conflict resolved at the original site?	Was conflict resolved for the community?
Mataranka, NT	BR	>200,000	BHLNOSW	no	no	<300 m	uk	>9		no	no
North Eton, Qld	B	4800	VNFB	uk	no	<1.5 km initially	yes (≈4 majority temporary)	2	45,000	yes	yes (conflict at one site)
Royal Botanic Gardens, Melbourne, Vic	G	30,000	NS	no	no	6.5 km	yes (2)	6 mths	$3 million	yes	yes, ongoing management required
Royal Botanic Gardens, Sydney, NSW	G	3,000	LNPOW	no	no	4 km	no	ongoing daily actions for 12 mths	>$1 million and ongoing	yes	yes
Singleton, NSW	GR	500	LNUW	no	no	<900 m	no (returned to original site	>3	$117,000 and ongoing	no	no
Townsville, Qld	BR	35,000	BNS	no	no	400 m	no (returned to original site)	5		no	no
Warwick, Qld	GRB (dispersal targeted R)	200,000	NLBP	no	no	≈1 km	no (site known to be previously occupied by GB)	5 days	$28,000	yes	uk (complaints persisted until migration)
Young, NSW	L	<5000	VN	no	no	<600 m	yes (1)	uk		yes	no

* G = grey-headed flying-fox; B = black flying-fox; R = little red flying-fox; uk = unknown

B = “birdfrite”; F = fog; H = helicopter; L = lights; N = noise; P = physical deterrent; O = odour; S = smoke; U = ultrasonic sound; V = extensive vegetation removal; W = water.

Appendix 2 UFFMA

N

CASSOWARY COAST REGIONAL

TABLELANDS REGIONAL

Abergowrie

Garrawalt

Dalrymple Creek

Long Pocket

Macknade

Lucinda

Coral Sea

Bemerside

Hawkins Creek

Halifax

Gairloch

Foresthome

Cordelia

Lannercost

HINCHINBROOK SHIRE

Braemeadows

Wallaman

Victoria Plantation

Taylors Beach

Trebonne

Ingham

Peacock Siding

Blackrock

Forrest Beach

Toobanna

Palm Island

Wharps

PALM ISLAND ABORIGINAL SHIRE

Helens Hill

Orient

Upper Stone

Mount Fox

Yuruga

Bambaroo

Coolbie

CHARTERS TOWERS REGIONAL

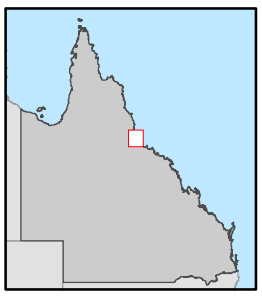
TOWNSVILLE CITY

HINCHINBROOK SHIRE

Legend

- Urban Flying-Fox Management Area
- Local Government Area
- Road

0 2.25 4.5 9 13.5 km



Urban Flying-Fox Management Area

COORDINATE SYSTEM: GCS GDA 1994
HORIZONTAL DATUM: GDA 1994

MAP PRODUCTION
29 July 2013
Nature Conservation Services
Department of Environment and Heritage Protection

Queensland Government

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	13/04/2015	Ingham flying-fox roost management advice	Kim Heynen, Senior Environmental Scientist	Jess Bracks, Senior Wildlife Biologist	Leigh Knight, Senior Environmental Planner

Distribution List

Copy #	Date	Type	Issued to	Name
1	13/04/2015	Electronic	Paula Ingerson	Hinchinbrook Shire Council
2	13/04/2015	Electronic	Ecosure	Administration

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