Cute, furry, useful and hated

From agricultural pest to environmental icon, changing community attitudes on environmental issues: Flying-fox case study.

Executive Summary

Due to rapid urbanisation and industrial growth, human-wildlife encounters have become increasingly common. Habitat encroachment is one of the adverse effects of urban expansion, which often results in the disruption of local biota. Australian flying-foxes residing near urban areas are often impacted by these disruptions. As a result their presence has caused conflict with residents.

Drawing on fields of psychology, behavioural economics seeks to understand why humans do the things they do, and how to frame policy to influence these behaviours so as to achieve the desired behavioural change. Behavioural economics has been well appropriated in the fields of marketing and business, and of recent emergence, in the application of environmental policy. This research paper looks at working examples of behavioural economics in relation to environmental conservation, with the intention of appropriating such examples to the Grey-headed Flying-fox of Balgowlah, Manly.

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Research Statement

Analysis of environmental attitudes, beliefs and behaviours to develop practical and effective community engagement strategies: Case Study Balgowlah Grey-headed Flying-fox Camp.

1. Introduction

Population growth has led to an increase in urbanisation which encroaches on natural habitat. As a result, humans are coming into contact with wildlife more frequently (Van der Ree *et al.*, 2006). Conflict arises when local wildlife disrupts human lifestyle and livelihood, often resulting in expulsion or eradication of the fauna. This removal or reduction of populations can have negative impacts on local ecosystems or even threaten the survival of the species (McDonald-Madden *et al.*, 2005). Therefore, the cohabitation of humans and fauna can often be key to maintaining environmental balance.

Policy-makers and environmental awareness groups, such as the Manly Environment Centre (MEC), are eager to assess whether efforts to induce pro-environmental responses (attitude/behaviour) amongst the public are effective (Witmarsh 2009). It is widely agreed that most instances of environmental deterioration are consequences of lifestyle choices (Schultz 2011). Therefore, efforts to promote conservation require a shift in these lifestyles, and ultimately the attitudes and behaviours that dictate them (Schultz & Kaiser 2012).

Attitudinal studies are increasingly being adopted as tools for evaluating public understanding, acceptance, and the impact of conservation interventions (Schultz 2011). These findings are often useful in guiding policy (Eden & Huxham 1996). Historical, political, ecological, socio-cultural and economic conditions play a large role in shaping attitudes, and ultimately, the strategies required to change them.

Flying-foxes (FF) in Australia have come under attack from humans since European settlement. Historically they have been viewed as a food source (Vardon *et al.*, 1997) and a pest (Rose &

Tsumura, 2010). Due to culling and destruction of habitat, FF numbers have decreased significantly and FF are now listed as a threatened species (Commonwealth Environment Protection and Biodiversity Conservation Act, 1999). Recognised for their ecological importance they are also considered a keystone species (QPWS, 2001) (Thiriet, 2005). Although this environmental status is acknowledged legally, this view is often contradicted by local communities. For local residents, the negative impacts of living near a roost can sometimes outweigh any benefits they provide (KBCS, 2001). Previously dispersal methods have been used as an attempt to relocate FF. However this procedure has proven to be ineffective, costly and poses a threat to the health of FF (Thiriet, 2005) (Roberts *et al.*, 2012). Therefore, cohabitation is key for the survival of the species.

This report aims to develop practical and effective community engagement strategies to facilitate coexistence of humans and FF. Balgowlah, New South Wales, has a colony of 6000 Grey-headed Flying-foxes (GHFF) and has been used as a case study site. Local environmental campaigns (both successful and failed) and Australia wide FF community engagement strategies have been assessed and evaluated in order to understand the issue further.
Intervention strategies based on psychology have been investigated to establish how they can promote long-term, cost effective, pro-environmental behavioural change. From this information, site specific recommendations have been compiled to address the issue of community conflict at Balgowlah. Furthermore the research, methods and findings from this report can be applied to other environmental issues, where conflicts between humans and nature arise.

2. Methods

This paper draws together work from the social and natural sciences to present an interdisciplinary overview of attitudes towards FF. It provides a unique methodological tool with which to examine psychological and environmental issues and can serve as a valuable contribution to policy and sustainability.

2.1 Study Population

The target study population varied based on research aim. The micro-scale study population was the residents of the northern Sydney suburb Balgowlah, where FF complaints were common. To ensure adequate representation of this small population, Australia-wide case studies were considered. Meso-scale population data (AUS) was used to established a broad understanding of opinions and current management strategies of FF. Macro-scale study populations included worldwide psychological findings on attitudes towards the environment.

2.2 Preliminary Data

Preliminarily data was obtained through publically available datasets to establish the scope of the issue. An initial meeting with Judy Reize Founder of MEC, provided context, and identified pressing issues and research requirements - “How do we change the Manly community’s perceptions towards FF and what management strategies do you suggest?”. Contacts, and sources of further information were gained from the meeting.

2.3 Study Aims

Major study aims were identified to establish a clear understanding of the type of data to collect and analyse. The aims included: 1. Understand the importance of FF; 2. Gain insight into the micro, meso and macro perceptions of FF; 3. Assess past and present strategies of management for FF; 4. Determine value orientations of Manly community; 5. Assess strategies in changing perceptions towards the environment; 6. Develop a cost benefit analysis of the most appropriate solutions for Balgowlah, Manly.

2.4 Site Analysis

Multiple site visits were conducted to assess extent of FF roosting, and proximity of residential houses to the FF camp. Morning and noon assessments were prioritised to understand noise and activity habits at peak hours of FF activity. Issues of smell were evident, and fecal contamination observed. Site observations were used in conjunction with satellite imagery and council maps to establish vegetation types and extent, roosting size and position, extent of affected houses, location of signs and bike paths, as well as site aspect, slope, wind direction and surrounds. This information guided investigations into solutions for the site.

2.5 Data Collection

Secondary research began with the intention of gaining a multidisciplinary perspective of our research problem. Data included government documents, official statistics, technical reports, and scholarly journals. When evaluating the quality of these sources, the original purpose of the data was considered to discern any potential level of bias (Novak, 1996). To address the limitations of secondary data, such as generalisations of one's findings, we obtained data from multiple sources to strengthen the validity of our findings. We also merged data from different levels (micro, meso, macro) to link contextual variables.

The demographics of Manly were analysed based on Census data between 2010-2015. Variables in demographic were explored spatially and temporally with objectives of understanding community values and uptake of pro-environmental initiatives.

Data on flying-fox biology and ecology were compiled from a survey of the peer-reviewed articles published in books and reputable journals.

Statistical information on FF dispersal and relocation attempts was obtained from case studies around Australia. Published articles, government documents, and informal interviews with council members provided an overview of the problem, community responses, and management strategies. Personal communications could carry inherent biases; this was addressed by cross-referencing communications with research findings from as many sources as possible.

Perceptions of FF were assessed on a global scale, from current and historical sources. This included field notes form biologists and naturalists (P. Eby, B. Roberts, M. Williams, J. Kennedy); records of interest, long-term residents near FF camps, and interviews with council staff.

Costs associated with the management of FF were obtained from case studies and involved stakeholders. Costs were allocated to one of several categories including consultant fees, wages, management plans, logistics, research, and maintenance. Actual costs were difficult to obtain and it is likely that some components have not been included in the total cost.

2.6 Viable Extraction

The data obtained was filed and shared to ensure collaboration and understanding throughout the project. This data can be used by project members, and MEC upon request, to guide future projects and further investigations. Secondary data analysis enabled access to well-collected, longitudinal and diverse samples, and saved time on costly field studies and surveys.

Disciplines of psychology, history, economics, behaviour, humanities, and multispecies ethnography enriched the research process. This trans-disciplinary conceptualisation is rare in environmental sustainability research.

The initial broad research enabled unique comparisons of a breadth of variables. This was scaled down, with data selected based on appreciation to research question.

3. Case Studies: Human Behaviour & Environmental Awareness Campaigns

An evaluation of social, cultural, and environmental movements in Manly has been undertaken to gain insights into the core values of Manly community members. Several campaigns have been reviewed to establish success and failures and the driving forces behind these outcomes. This information will be used to provide an in-depth understanding of the types of triggers necessary to establish pro-environmental behaviour.

3.1 Behavioural Drivers

Behaviour is driven by the perceived threat to things we value (Schwartz 2011). That is, the extent to which an environmental condition threatens an object of value, directly influences the extent of action taken towards mitigating or adapting to that threat. Schwartz 1994 developed three distinct value bases for environmental concern:

1. Egotistical - protecting the environment oneself
2. Social-altruistic - protecting the environment based on the long-term impact it could have on other people
3. Biocentric - perceived inherent value of the environment

These values are now more commonly known as egocentric, anthropomorphism and ecocentric respectively. Table 1. Highlights the 52 dimensions of values, which are considered to be universal across all people (Schwartz 1994). The amount of importance individuals place on each of these values dictates the subsequent egocentric, anthropocentric or ecocentric category they fall into. By understanding the values and motives of demographics, intervention strategies can be tailored to trigger the desired environmental response.

Extending on Schwartz's value based theories, Stern (2000) proposes four key proponents to environmental concern:

1. *Values, beliefs, attitudes*
2. *Contextual Forces*

3. *Personal Capabilities and Resources*
4. *Habit*

This case study delves into these four components, and how they have influenced social, cultural and environmental movements in Manly. Additionally we look at the four main challenges in changing humans' behaviour, and how these have been used or misused in Manly environmental campaigns (Schultz 2011):

1. Education does not typically result in an increase in conservation behaviour
2. Human thinking is biased and promotes short sighted responses to environmental threats
3. Individuals generally perceive themselves as separate from nature
4. Social norms guide behaviour

Table. 1.
Value-items from Schwartz's values instrument (Schwartz 1994)

Self-Transcendence	Self-enhancement	Openness	Tradition
Universalism	**Power**	**Self-direction**	**Tradition**
Protecting the environment	Social power	Creativity	Devout
A world of beauty	Authority	Curious	Respect for tradition
Unity with nature	Wealth	Freedom	Humble
Broad-minded	Preserving my public image	Choosing own goals	Moderate
Social Justice	Social recognition	Independent	Accepting portion
Wisdom	**Achievement**	**Stimulation**	Detachment
Equality	Successful	Creativity	**Conformity**
A world at peace	Capable	Curious	Politeness
Inner Harmony	Ambitious	Freedom	Honouring parents and elders
Benevolence	Influence	Choosing own goals	Obedient
Helpful	Intelligent	Independent	Self-discipline
Honest	Self-respect	**Hedonism**	**Security**
Forgiving		Pleasure	Clean
Loyal		Enjoying life	National security
Responsible			Social order
True-friendship			Family security
A spiritual life			Sense of belonging
Mature love			Reciprocation of favours
Meaning in life			Healthy

3.2 History of Manly

In 1873 the Port Jackson and Manly Steamship Company initiated push for tourism in conjunction with the rapid industrial and commercial expansions. A ferry service was established, along with resorts and pier attractions, and Manly was donned the phrase “seven Miles from Sydney and 1000 miles from care”. This delicate entanglement of industry, nature and tourism gave rise to the cultural, economic and environmental status that precedes Manly today.

3.2.1 Manly Environment Centre

The driving force behind major environmental campaigns in Manly has been the Manly Environment Centre (MEC). The MEC was established in 1991 - a partnership between the community, council and local corporate sponsors. The aim of the centre was to promote action and education towards environmental issues facing Manly. To date, the MEC contains the largest collection of environmental education material accessible to the Australian community. Despite this, environmental issues persist, and the MEC continues to battle with eliciting pro-environmental change.

Interestingly, in opposition to what traditional models of behavioural economics might suggest, when threats to resources arise, cooperative behaviours have a tendency to emerge. That is, threats of overexploitation promote a cooperative response within groups, rather than self-preservation. This behavioural phenomenon is evident with the establishment of the MEC. In the late 1980’s a groundswell of community concern evolved in response to pressures of development, tourism and pollution facing Manly. A group of environmental enthusiasts, led by Judy Reize and volunteers, sought to partner with Manly Council and local businesses to rectify these pressing issues. In March 1991 the Manly Environment Centre (MEC) opened, and ran for 12 months thanks to the in-kind, relentless dedication of volunteers. To date, the MEC operates out of a small, shared building, close to the Manly foreshore, in conjunction with the Australian Marine Conservation Society, Manly Food Co-Op, Surfrider Foundation and Greenlive Consulting.

Some of the major achievements of the MEC include listing Little Penguins and Bandicoots as threatened species (Threatened Species Act 1995), the development of the first marine sanctuary in Sydney - Cabbage Tree Bay, Manly Solar Surf Club, Kind Companies and Creek project (below), and the successful replanting of Manly’s Norfolk Pines.

In 1994 an *eco-operation* was established between local schools, OZ G.R.E.E.N, Blackmores Ltd and MEC. This partnership saw the development of the Kids, Companies and Creek campaign, with the objective of improving the health status of Manly through multi-stakeholder engagement. This project remains an ongoing success, and has since been used by the Environmental Protection Authority (EPA) as a case study for ”best practice”.

3.3 Demographics of Manly

Research into the social bases of pro-environmental behavior suggests that social class is a major contributor to the choices and decisions individuals make (Dietz et al 1998). While economic metrics and financial barriers are deemed insignificant in determining environmental behaviours (Stern 2000), social, cultural and political factors are proving to be major contributors to environmental action (Brechen et al 2011; Escobar 1998; Stern 2000). Understanding the cultural, social, and political context of Manly is therefore paramount. The motives (values and attitudes) behind social movements will provide a guide for psychological based intervention strategies.

An individual's attachment to, and satisfaction with, place are key determinants of environmental concern (Samdahi & Robertson 1989; Lorenzoni et al 2007). In Manly a large portion of social, cultural and economic values are derived from the environment. Real estate in Manly, for example, is among one of the highest in Australia, promising a relaxed lifestyle, proximity to the city, and seaside location. This value of place, and its ability to generate economic and social recognition, is an important function of environmental conservation efforts (Gosling & Williams 2010). When the aesthetics, lifestyle, and social advantages are in jeopardy, Manly residents pursue protection efforts in order to preserve these values, this is particularly evident in Manly community’s continuing efforts to preserve Manly Beach (see below).

Three schools are located within the Manly LGA: Manly Village Public School (K-6), St Paul's College (boys 7-12), and Manly Selective Campus (7-12). An elitist culture is present within these educational institutions, placing a high value on money and material goods. This manifests throughout the community and gives rise to a culture of egocentrism. As explored by Schwartz (1994), conservation values based on egocentrism are associated with social power, authority, wealth, preserving one's public image and social recognition (Table. 1.). When environmental issues are framed in a manner that jeopardizes these egocentric values, conservation efforts are

initiated. This is particularly evident in the community's response to protecting Manly beach, as explored in the case studies below.

3.4 Manly Case Studies

3.4.1 Norfolk Island Pine Trees

The Norfolk Island Pine Trees, first planted in the 1850s, are an iconic symbol of Manly (Westbrook 2014), and have received significant attention regarding their protection / removal throughout the decades. The Norfolk Island Pine tree case study provides key insights into why the community partakes in pro-environmental campaigns.

The Norfolk Island Pine Trees dot the shorelines of Manly beach, and are highly sensitive to pollution. While they do serve as an indicator of ecosystem health, they provide fewer ecosystem functions than those of other species, such as the threatened species of seagrass that lines Manly Lagoon (MEC 2016). Less iconic species such as Eucalyptus Woodland, *Angophora costata-Corymbia gummifera and Sydney Ironstone Bloowdood-Silvertop Ash Forest (Duffy's Forest) are* readily removed for the sake of development, and receive minimal resistance in response to their removal (NBC 2016). The Norfolk Island Pines on the other hand are iconic, they represent the deep heritage and history of Manly Beach, and form an important part of the foreshores aesthetics and subsequent identity (McNarin 2014). When the council suggested the Norfolk Pins should be removed (NBC 2016) an uproar of protest was elicited from the community. Evidently, these efforts to preserve the Norfolk Pines do not come from an ecocentric value basis, rather, their origins stem from egocentric and anthropomorphic orientations. The economic social and cultural motivations that drive their preservation give insight into the values of the community,

Interestingly, this visual anchor successfully generates conservation for other species. This 'subconscious' mechanism of Norfolk preservation is a similar conservation strategy to one commonly known as "flagship species". Flagship species are used to generate awareness, funds, and actions towards conservation. These species are often charismatic and iconic, and their habitat represents a host of species also in need of conservation. The attention, effort and money directed towards the flagship species, also aids those who are "less-charismatic" by improving habitat and leveraging conservation commitments (Soniak 2014). In this sense, protection of the Norfolk Island Pine Trees has facilitated subsequent protection of seagrass species, benthic flora and fauna, and otherwise unrecognised and uncharismatic species that serve vital ecosystem functions. Applying

this method to other environmental issues in Manly could be an effective means of improving the health of this sensitive system.

3.4.2 Manly Beach

As illustrated in the Norfolk Pine Case Study, environmental concern is generated through three general responses: egocentric, anthropocentric and ecocentric value orientations. Stern 2000 argues an additional concern response is also at play - when objects of value are perceived to be under threat. In the case of Manly Local Government Area (LGA), pro-environmental behaviour is most commonly invoked when people's values, or objects of value are under threat (Stern 1994) .

A prime example of how threats to an object of value can initiate environmental action is demonstrated in the support for Manly Beach. March 2012 saw the development of the Manly-Freshwater World Surfing Reserve, dedicated by Kelly Slater, American professional surfer, and Marie Bashir, former Governor of NSW. The appointment of this reserve was triggered by threats to cultural and social values and provides a unique working example of they types of mechanisms that are effective in activating pro-environmental change in Manly.

Manly Beach is considered the birthplace of surfing in Australia (National Surfing Reserves 2016). In 1915, Duke Kahanamoku televised an infamous body surfing demonstration, inspiring thousands of Australians to take up surfing. Following this, in 1964, Manly Beach held its first World Surfing Competition, setting light to the culture of surfing so ingrained in Manly today. Manly remains one of the most popular beaches in Australia (National Surfing Reserves 2016), and this deep heritage serves as the driving force behind conservation efforts.

Mike Baird, Chairman of Manly National Surfing Reserves, highlights the role of anthropogenic values operating at Manly Beach and the subsequent conservation motivators that follow:

> *“The recognition of Manly and Freshwater beaches as National Surfing Reserves has confirmed what many locals in my community already knew - that we have a place of unqualified beauty deserving of preservation and celebration”*

This statement highlights some of the reasons as to why the environmental campaigns used to protect Manly Beach have gained so much community attention.

The Manly-Freshwater World Surfing Reserve demonstrated how the historical, social and political contexts of place play a large role in conservation efforts. The value origins of these conservation efforts stem from power, hedonism and security (Table 1.). In relation to power, the health of Manly is important to residents as it offers public recognition, wealth, and social authority. In addition to this, Manly Beach also provides a space to be creative, to freely express oneself and to take pleasure in life, giving rise the hedonistic value origins of conservation. Perhaps most importantly, are the security values associated with beach health – Manly beach represents a sense of belonging, health, social order, and cleanliness, whereby threats to the beach directly threaten these values. It is with this understanding that the reasons behind an individual's investment in protecting Manly Beach become clear, and potential intervention strategies for the GHFF case study can be formed.

According to the Poghosyan (2015) campaigns which have a high value, a large customer range, and diverse and flexible consumers are ideal for the use of celebrity endorsement marketing strategies - i.e. very fitting for environmental issues. The use of 'Beach Icons' such as Barton Lynch, and Layne Beachley, to promote the ongoing preservation of Manly Beach, has played a significant role in maintaining community interest. A marketing and research paper published in Dublin 2014 (McDonagh & Prothero 2014) looked at the power of celebrities in influencing consumer behaviour. This research found that celebrity endorsements bring attention, credibility and emotional bonds to the topic of discussion, and are thus most commonly used for political campaigns, product advertising and brand recognition (Euromonitor International Market Research Company 2014). Despite this globally understood advantage of celebrity endorsement, its use in environmental campaigns (much like other effective marketing techniques) remains relatively untouched.

3.5 Challenges - Changing Human Behaviour

In line with this thinking, the main efforts employed by MEC to change attitudes and behaviours towards the environment are consistently proven ineffective by social and behavioural psychologies around the world (McKenzie-Mohr et al. 2012). Schultz (2011), delves into four main challenges to changing human behaviour, namely cognitive biases, social norms, education, and human-nature binaries. We will now look at how these challenges have hindered the uptake of environmental

initiatives in Manly, and alternatively how to leverage intervention strategies to avoid such struggles in the GHFF case study.

3.5.1 Cognitive Biases

Humans are remarkably irrational beings. Our beliefs are subject to a host of cognitive and perceptual biases often resulting in the uptake of attitudes and behaviours that go against rational thought (Schultz 2011). This irrationality is commonly identified in issues of environmental conservation. Both spatial and temporal contexts play a role in determining people's perceptions about the severity of environmental issues. In a study conducted by Gifford *et al.*, (2008), individuals reported environmental problems as more severe on a global scale than on a local scale (i.e. things are better here than there), and often held the view that environmental conditions were going to worsen with time (i.e. better now, than later) (Gifford *et al.,* 2008). As such, less importance was weighed on factors that threaten ecological conservation, compared to other more tangible issues such as the economy, traffic conditions and national security (Gifford *et al.,* 2008). Individuals feel a stronger sense of personal responsibility to these issues (traffic, security, economy etc.) and are therefore more motivated, and thus likely, to act on them (Uzzell 2000).

3.5.2 Cabbage Tree Bay

In 1991 the ecological communities of Cabbage Tree Bay were identified as under threat from recreational uses within the area - docking boats, spearfishing, snorkelling, rubbish dumping, scuba diving etc. In effort to raise awareness of this damage the MEC employed a myriad of information strategies, such as phone calls, emails, face to face meetings, newspaper articles, community consultations etc., only to be met with continued resistance. Stakeholders (i.e. fishermen, surfers, boat owners, tourist etc.) were not interested in sacrificing the immediate pleasure they received from using the bay, for the sake of long-term preservation.

Complicating things further was the environmental report from a 'qualified ecological consultant' claiming nothing requiring protection, and nothing threatened by the activities in the bay. This fuelled further opposition to the insinuated threats of current activities operating within the bay, and stakeholders refused to change.

This conflict stems from two psychological grounds - cognitive biases and social norms (Schultz, 2011).

Cognitive biases are tendencies to think in ways that deviate from rationality or good judgement. In the case of Cabbage Tree Bay, the ecological consultants argument of “nothing there”, simulated a multitude of cognitive biases, and helped to strengthen stakeholder’s resistance to change:

- Authority Bias - the tendency to attribute great accuracy to the opinion of an authoritative figure.
- Confirmation bias - the tendency to search for, focus on, interpret and remember information in a way that confirms one's perceptions
- Anchoring - the tendency to rely too heavily, or anchor, on one piece of information when making decisions
- In-group Bias - the tendency for people to give preferential treatment to others they perceive to be members of their own group

These biases are common in issues of environmental conservation, and they highlight the strong psychological undertones often driving people’s behaviours and attitudes towards the environment.

3.5.3 Social Norms

Additionally, the concept of social norms influences attitudinal and behavioural responses towards the environment. Humans tend to look to the behaviours of others to guide decision and actions, and are often reluctant to deviate from the social norm. In many situations, as in the case of Cabbage Tree Bay, the social norms held by stakeholders (spear fishing, recreation, boat driving) do not favor conservation. When this norm is coupled with the idea that others are partaking in conservation efforts at a lower rate than oneself, the norm is reinforced, and resistance to change surmounts (Schultz 2011).

A study conducted by Bardi and Schwarts (2003), highlights the connection between values and behaviour, and how these values are readily obscured by social norms. Three types of social norms are identified as influencing behavioural and attitudinal change:

- Descriptive - guiding behaviour based on the perception of how most others would behave
- Injunctive - guiding behaviour based on how most others would approve/disapprove a person's conduct
- Personal - guiding behaviour based on the perception of how a person would approve/disapprove one's own conduct

At any given time, an individual's actions are likely to conform to the social norm of which they are most familiar. In these instances, even when other norms suggest contradictory conduct, the default norm dictates decision -making (Cialdini et al. 1991). In the case of Cabbage Tree Bay, the vast majority of individuals within each stakeholder group guide how subsequent group members think feel and act (injunctive norms). Any thoughts or opinions outside of the group norm are uniformly rejected, and as a result, a general consensus - that Cabbage Tree Bay is not under threat - emerges. Even if information, or personal values, run counter to group consensus, the preference to think act and feel as the 'group' does, overrides.

When an individual's behaviour is framed against others within their peer group, and these behaviours do not 'match up', there is a tendency for individuals to change in order to meet the perceived norm. Allcott and Mullainathan (2010) and Ferraro and Price (2010), delve into this concept of social comparison in their studies on electricity and water consumption. Allcott and Mullainathan (2010) use the social norm activation method to compare household energy in the United States. Over a 12 month period residents study saw a 27% reduction in overall electricity use. As a conservative estimate, this psychological intervention strategy, if applied on a broader scale, could save the US approximately $2,220 million/year.

Creating cues, however, which suggest widespread support of conservation activities and pro-environmental behaviour has been proven to be the most effective method of facilitating change. A Ted Talk conducted by Jeni Cross (Cross 2013) looked at the impact of two different marketing campaigns on reducing litter. The first marketing campaign (A) was an interactive sign that advertised the amount of rubbish left around a bus stop each week. This is a commonly used (and flawed) environmental strategy, which relies on showing people the environmental issue in an attempt to stop the damaging behaviour. The other marking strategy (B) pictured an Olympic runner putting rubbish in the bin, commenting on how she cared about her city. Of these two campaigns, strategy A was the least effective as it modelled the in adverted norm i.e. the norm we did not want people to participate in. Strategy B however, utilised the power of social norms by modelling the desired behaviour as the standard (and expected) behavioural response. Cross (2013), highlights the common marketing failures of environmental campaigns, which often increase the instances of behaviour that they are trying to reduce. By understanding the power of social norms, and applying them in the correct way, efforts to change the behaviours towards the GHFF become seemingly achievable.

Interestingly, in the case of Cabbage Tree Bay it was not until a private consultation between Eddie Hegerl (Founder of the Australian Marine Conservation Society) and chosen representatives from each stakeholder group, that these cognitive biases and social norms could be readjusted. Hergerl is well known for his conservation work with the Great Barrier Reef. His involvement in Cabbage Tree Bay brought a seemingly unbiased point of view, and with this, stakeholders immediately felt a sense of trust, regard, and objectivity.

Hergerl's approach to changing attitudes was innately different to those employed by MEC. While the MEC focused on more informative measures - highlighting the damaging effects stakeholder's behaviours (inadvertently promoting the social norms) Hegerl was able to represent the information in a way that was value orientated, tangible, and activated pro-environmental social norms. In reference to his work at the Great Barrier Reef, and how communities much like Manly were investing time, money and effort in preserving these vulnerable ecosystems, a new social norm, which aligned with the desired outcome of conservation, was triggered.

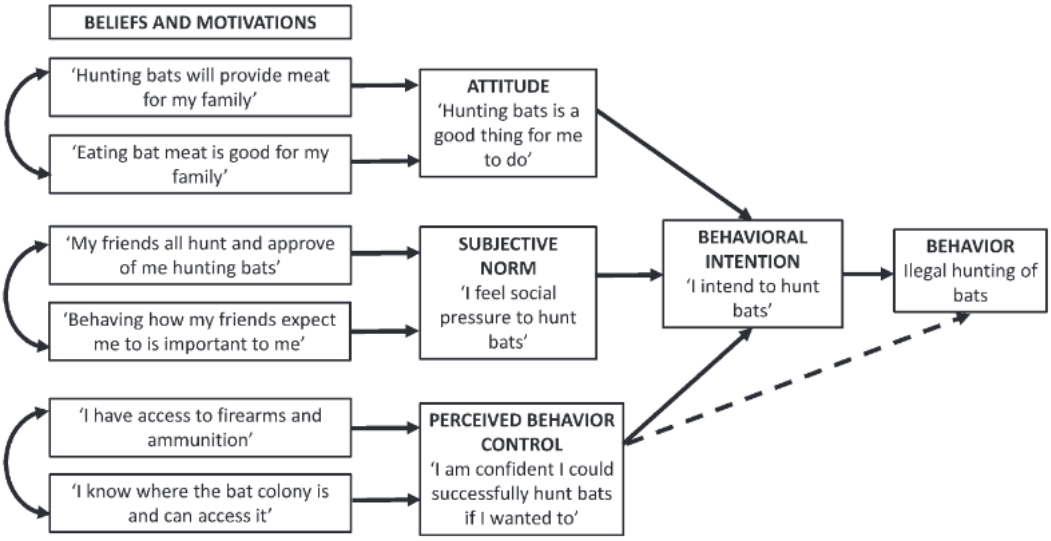
Hergerl's ability to convey the significance of Cabbage Tree Bay to stakeholders enabled a shift in perceptions of both group 'leaders' and their corresponding group members. By aligning values of Cabbage Tree Bay preservation, with those of each stakeholder group, efforts to conserve this vulnerable ecosystem were adopted as necessary.

This *eventual* success story brings to our awareness the underlying power of values, social norms, and psychological predispositions (biases) in determining attitude and behaviour. Understanding the influence of these factors enables a means of controlling them (Kahneman 2011), and as such, policies and intervention strategies can be designed to change them.

3.5.4 Education

Constraints to individual engagement with environmental issues have implications for governments, industry and communities in achieving desired environmental outcomes. Globally, there is increasing attention on public engagement as a means facilitating change around scientific issues. Traditionally efforts have been concentrated on the provision of scientific information so as to educate the public, change behaviour and gain support for policy (Eden & Huxham 1996). This "deficit model" however, fails to consider the role of social values, personal experience and demographics in driving attitudes and subsequent behaviours towards the environment. Figure 1. explores the theory of planned behaviour in response to illegal hunting of bats. It highlights the

different influences of behaviour, and brings to light the role of social norms, attitudes and



motivations in constructing actions.

Figure 1. The strength of attitude, subjective norms, and perceived behavioral control in determining actions of illegal hunting of bats (St John et al, 2014).

Furthermore, Lorenzoni et al (2007) explores the genesis of engagement, suggesting that care, motivation and an understanding of environmental issues is necessary to engage audiences and facilitate behavioural change. As explored above, contributing to engagement levels are the social and institutional contexts in which information is delivered, and the habits, personal capabilities, and experiences of demographics. Lorenzoni argues that the provision of targeted and tailored information to citizens and communities is necessary - in conjunction with policy - to generate long-term cost effective behavioural change.

In March 1998, MEC developed the Manly Conservation Strategy. The main objective for this strategy was to assist the long-term visions for Manly, and develop community action plans in response. As explored by Osbaldiston and Schott (2006) there 10 ways to instigate behavioural change. The least effective of these measures, despite popular belief is the provision of information

(i.e. education). Herein lines the issue with most pro-environmental campaigns. The MEC for example, while recognising the importance of delivering information in new and alternative ways, (their greatest success have come from doing so), focus most of their attention on providing public access to educational material. The MEC provides locals with 10,000s of free resources in the form of multimedia, research papers, audio, videos, DVDs, and council documents such as policies, regulations and management strategies.

Osbaldiston and Schott (2006) ranked ten types of intervention strategies according to their efficacy in promoting behavioural and psychological change. As listed below, Osbaldiston and Schott classify cognitive dissonance, goal setting and social modelling (i.e. social norms), as the three most effective means of inducing behavioural change. Their research also found that by combining any of these intervention strategies, the resulting change was even more profound. In regards to the MEC, the most commonly used strategies to encourage pro-environmental behaviour ranked lowest on the list (or were not mentioned at all). In many government institutions education, instructions, and feedback are commonly misappropriated and misconceived as effective in generating change (Cross 2013).

Order of most effective intervention strategies to promote behavioural change (Osbaldiston and Schott 2006):

1. *Cognitive Dissonance*
2. *Goal Setting*
3. *Social Modelling*
4. *Prompts*
5. *Making it easy*
6. *Rewards*
7. *Justification*
8. *Commitment*
9. *Instructions*
10. *Feedback*

Bartle (2011) explores these concepts of information sharing, and how the way in which we frame information can influence the degree to which members accept and have confidence in that information. Bartle found that online interactive platforms, delivering information about cycling, were the most effective means of framing information so as to elicit attitudinal change (compared to

pamphlets, websites etc.). Experienced and inexperienced cyclists (those with reservations/aberrations towards cycling) were invited to join web platform where information and questions could be shared openly and honestly between the two cyclist groups. This method not only built social ties, but also increased the perceived reliability, knowledge and trust in information being delivered. Positive attitudes towards cycling increased, and the emotions, subjective opinions and social support associated with this type of information sharing facilitated a positive behavioural response. This study is important to consider when designing intervention strategies for the Manly GHFF camp. Providing an online, interactive platform between GHFF knowledge enthusiasts and those less-informed, may be a more effective means of changing attitudes than “official” information mechanisms (pamphlets, websites etc.), commonly employed by MEC.

3.5.5 Human-Nature Binaries

Humans tend to view themselves as separate from nature. In a world of growing populations and increasing urbanisation, the emergence of human-nature encounters has become a topic of increasing importance. The belief of separateness from nature, commonly held by individuals and groups, manifests itself in the policies, programs and actions humans create at both micro and macro scales. Gosling and Williams (2010), and others (Schultz 2001; Mayer & Fratz 2004), have found that individuals with a greater perception of connectedness (between themselves and nature) are more likely to participate in conservation type behaviours. Therefore, by promoting this idea of connectedness has the potential to increase conservation behaviour.

Multispecies ethnography and environmental humanities explore this relationship between nature and culture, and the subjectivity, and agency of organisms whose lives are entangled with humans. While these fields recognise a need to view the environment differently, what they lack is methodology to do so.

Within this human induced ‘separateness’ lie psychological biases, which set up preferences for conservation of some species over others. Humans are predisposition to like species based on their shared bio-behavioural traits (Soniak 2014). The closer animals are to our human-centric worldview, the more likely we are to feel morally obligated to protect them (Psychologist Jackie Abell). On the other end of the bias spectrum, dislike for a species is enhanced when they have ‘bad reputations’. Bats are frequently associated with disease, are considered bad omens, and are generally perceived as *alien* to humans. In a study conducted by a Swiss conservation group, the greater mouse-eared-bat, although relatively cute compared to other bat species, was rated the

least-liked species out of a group of mammals (Schlegel & Rupf 2010). This dislike stems from a perpetual myth of vampirism, and blood sucking - a habit of a single species in South America. As a consequence, like many other nocturnal creatures, bats give rise to primal fears, and this dislike and separateness persists (Schlegel & Rupf 2010).

Eva Bodwn-Jones and Abigail Entwistle, British conservation scientists, suggest that the novelty and unusual appearances of traditionally less charismatic species, such as GHFF, could be effective in generating public interest if marketed appropriately. The odd and ugly nature of these uncharismatic species has the potential to gain attention when individuals get tired of the 'usual suspects' (Soniak 2014).

3.6 Stories Behind Success

Some of the most effective environmental campaigns initiated by the MEC focus on providing audiences with tangible, and often shocking, examples of environmental issues. These methods, as proven by extensive literature (Osbaldiston & Schott 2006; Lorenzoni et al. 2007; Cialdini et al. 1991) are some of the effective means of facilitating pro-environmental behaviour.

3.6.1 Plastic Free Manly

The push for Plastic Bag Free Manly has encountered ebbs and flows of success, with different mechanisms of intervention having more influence than others. In the early phases of the campaign, Judy Reizes, Founder and Manager of MEC, collected all single-use plastic bags she encountered over the period of one month, and then laid in the collection for a photo-shoot with the Daily Telegraph (1991). This marketing strategy utilised two psychological means of initiating behavioural change – 1. Shocking the audience (with the magnitude of waste), and 2. Relating the issue (of single-use plastic bags) back to the consumer. These abrupt visual and tangible cues prompted a groundswell movement from the community to reduce the use of single-use plastic bags in Manly. Following this initial strategy, stories of the charismatic Little Penguins of Manly Beach were published, as more and more of these threatened species were being found wrapped in plastic bags. These reports evoked feelings of guilt and moral obligation within the wider community, and businesses, council and locals began increasing their efforts to ban plastic bags in Manly.

3.6.2 Manly's Little Penguin Colony

A prime example of how bio-behavioural traits of charismatic species influence conservation behaviours is observed in the fundraising efforts for Manly's Little Penguin Colony. Penguins are undeniably charismatic (Schlegel & Rupf 2010), and they appeal to human's aesthetic and emotional psychological biases.

Manly's Little Penguin Colony is the last in NSW. In 2015 the Foundation for National Parks & Wildlife ran a crowdfunding campaign in response to a fox attack, which resulted in the death of 26 penguins. The campaign involved a short video detailing the incident, the imminent threat posed to the Penguin Colony, and concerns regarding their possible extinction. The community's response to the campaign was far greater than anticipated, with $20,000 being raised to help FNPW re-establish the colony.

This overwhelming community response is psychologically understood when considering Stern *et al.,*'s (1993) value orientations.The study surveyed 349 college students in an attempt to understand the role of value orientations on environmental conservation efforts. His findings revealed that the perceived threats to objects of value independently predict people's willingness to take action. Additionally, threats to self see a willingness of individuals to pay (invest) in methods to stop or prevent such threats (Stern *et al.,* 1993). In the case of Manly's Little Penguin Colony, the recognised environmental threat (foxes), and their potential impact on objects of value (penguins) saw immediate efforts to raise funds for their conservation.

The success of these two strategies can be attribute to three factors. 1. Appealing to values: egocentric and anthropocentric value orientations associated with beach health. 2. Tangible information: audiences are able to visually comprehend the extent of plastic bag use. And 3. Charismatic species - the impact of plastic bottles on the Little Penguins of Manly Beach appeals to the shared bio-behavioural traits between humans and penguins.

4. Flying-Fox Background

Flying-foxes (FF) are of the family Pteropodidae, also know as Megabats or Megachiroptera (Richards & Hall, 2012). Pteropodidae are one of the eight families of bats found in Australia. FFs are distinctively larger than other bat families and can travel great distances to feed on flowers, fruits and leaves from a variety of trees and shrubs (Rose & Tsumura, 2010). Of the nine different species of FF found in Australia, three of these are distributed along the east coast of Australia; Grey-headed Flying-fox (GHFF) *Pteropus poliocephalus*, Black Flying-fox *Pteropus alecto gouldi* and Little Red Flying-fox *Pteropus scapulatus*. Both FF and bats have fallen victim to various conflicts with humans.

Though bats and FF are often referred to interchangeable, the problems and solutions referred to in this paper relate specifically, though not strictly, to the GHFF, which is listed as Threatened under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. The Black Flying-fox and Little Red Flying-fox are often found roosting amongst GHFF and are therefore for the sake of simplicity included under the term Flying-fox (FF).

4.1 Food, Flight & Roosting Sites

4.1.1 Roosting Sites

GHFF have established a number of roost sites throughout cities and towns along the east coast of Australia, this is likely due to a loss of native habitat and an increase in food availability in urban environments. Selection of roost sites also requires certain physical characteristics. A waterway such as a creek or stream is essential in roost selection (McClelland, 2009). FFs are at risk of overheating, and a wet understory provides an ideal microclimate (Richards & Hall, 2012; Loughland, 1998). Trees provide shade in summer and access to sun in winter and must be mature enough for substantial numbers to roost without the branch breaking (Ratcliffe, 1932). There is speculation as to the behavioural factors that contribute to camp location and fluctuations in numbers, but it is widely agreed to be linked to food availability and mating seasons (Parry-Jones & Augee, 1992). Roberts et al., (2012) suggests that movement between roost sites could improve mating and social opportunities and also enable FF to obtain information about food resources.

The length of time GHFF visit any one site was found to be highly variable (Roberts et al., 2012). GHFF regularly made short visits to multiple camps with stays often less than 5 days (Roberts et al., 2012), though individuals have also been known to stay several months at a single colony (Eby, 1991). Though individuals may regularly move between camps, a number of roost sites along eastern Australia have had some level of occupancy for decades (Parry-Jones & Augee, 2001). The permanent to semi-permanent camps that have some level of occupancy throughout the year are often maternity camps. These maternity camps increase substantially in size during mating season and warmer months (Tidemann *et al.*, 1999), and camps have been known to reach numbers of upwards of 50,000 (Parry-Jones & Augee, 2001). FFs show a strong fidelity to these traditional camps, which contributes to the difficulty in any and every relocation attempt.
As FFs are important pollinators and seed dispersers, disrupting their roost sites threatens the health of Australia's forests (QPWS, 2001; Thiriet, 2005)**.**

4.1.2 Migration

GHFF are extensively nomadic and movement is somewhat unpredictable as ranging and migratory behaviour varies between individuals. Roberts et al., (2012) recorded 14 individuals over a 25-week period and found that 77 roost sites were visited. The direction and distance each individual travelled was highly variable. The greatest distance travelled was 500 km over 48 hours, though between 100-200 km was more common (Roberts et al., 2012). GHFF have also been observed to travel anywhere between 4-37km in one night to feed (Eby, 1991). Camps are often at their peak during the summer months, while smaller group disperse during winter (Tidemann *et al.*, 1999; Tidemann *et al.*, 2004). From these findings it is evident that each FF camp does not exist as separate populations. GHFFs migratory behaviour suggests that they are instead part of a single mobile population (Webb & Tidemann, 1996), which fluctuates along its distribution as a response to food availability (Eby, 1991; Parry-Jones & Augee, 1992). This mobility means that GHFF and relatives provide an ecological service to Australia's forest by maintaining genetic diversity in an ever increasingly fragmented landscape (McDonald-Madden *et al.*, 2005).

4.1.3 Diet

GHFF are known to be generalist feeders, utilising fruit, nectar and pollen from both native and non-native species in a hierarchy of preference (Parry-Jones & Augee, 1991). Parry-Jones & Augee (2001) study on the Gordon camp in northern Sydney, found the most numerous pollen in

droppings belonged to the *Myrtaceae* and *Proteaceae* family. *Ficus* spp. was a common fruit source, with occasional incidents of high stone fruit when other food sources were low. GHFF also consumed leaves from the *Populas* spp. and *Avicennia marina* (Mangrove). A complete list of plants found in GHFF droppings from the Parry-Jones & Augee (2001) study can be found in Table 2.

The movement of large numbers of individuals is often the result of flowering or fruiting episodes (Parry-Jones & Augee, 1992). Such episodes are often irregular and may or may not occur annually depending on the plant species. The FFs ability to predict and locate such bursts in food availability is still unknown (Parry-Jones & Augee, 1992).

As urbanisation encroached on FF habitat, Australian native plant species were being planted in non-native locations, such as in city parks and backyards. For example *Eucalypyus ficifolia* native to Western Australia, *Grevillea robusta* native to northern NSW and *Myrtaceae* spp. native to Queensland and western NSW (Parry-Jones & Augee, 1991) have been planted in Sydney. These species provide year round food resources that the FF would have otherwise travelled great distances for (Roberts, *et al.*, 2012). *Ficus* spp. has also been planted in great density in Sydney than would otherwise be found in non-urban areas (Parry-Jones & Augee, 2001). This abundance in food has likely contributed to the year-round occupancy of roost sites in urban environments (Parry-Jones & Augee, 1991). Likewise trees native to Queensland and Northern NSW have been planted along streets and in parks in Melbourne since the 1970s (Williams *et al.*, 2006). In 1986 a FF colony was established in the Royal Botanical Gardens in Melbourne (McDonald-Madden *et al.*, 2005). The maturation of such food resources appears to have coincided with GHFF's expanding their distribution as far south as Melbourne.

Table 2. Food items in droppings of GHFFs at the Gordon colony site, NSW (1986-1989) Parry-

Family	Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Blossom													
Asteraceae	Unknown								+		+	+	
Arecaceae	*Livistona australis*								+				
Lauraceae	Unknown 1		+	+	+		+						
	Unknown 2							+	+	+	+	+	+
Malvaceae	*Hibiscus* sp.							+		+	+	+	
Myrtaceae	*Syncarpia glomulifera*									+	+	+	
	Angophora costata										+	+	+
	Melaleuca quinquenervia		+	+	+	+							
	Eucalyptus spp.	+	+	+	+	+	+	+	+	+	+	+	+
Papilionaceae	*Erythrina* spp.		+	+		+	+	+	+		+	+	
Proteaceae	*Grevillea robusta*							+	+	+	+	+	+
	Stenocarpus sinuatus	+	+	+	+	+	+						+
	Banksia serrata	+	+									+	+
	Banksia integrifolia			+	+	+	+	+	+				
Pinaceae	*Pinus* spp.							+	+	+	+	+	+
Urticaceae	*Dendrocnide excelsa*							+	+	+	+	+	
Fruit (native)													
Arecaceae	*Angophora cunninghamiana*					+							
	Livistona australis								+				
Cunoniaceae	*Schizomeria ovata*				+								
Euphorbiaceae	*Drypetes australasica*				+								
Moraceae	*Cudrania cochinchinensis*			+									
	Ficus spp.	+	+	+	+	+	+	+	+	+	+	+	+
Pittosporaceae	*Pittosporum undulatum*			+	+	+							
Rubiaceae	*Morinda jasminoides*										+		
Vitaceae	*Cissus* spp.	+	+		+			+					+
Fruit (introduced)													
Arecaceae	*Phoenix canariensis*		+	+		+			+				+
Oleaceae	*Ligustrum* spp.						+	+	+	+	+		
Moraceae	Mulberry									+	+	+	
Solanaceae	*Solanum mauritianum*		+		+	+	+	+	+	+	+	+	+
Fruit (cultivated)													
Ebenaceae	Persimmon			+									
Musaceae	Banana		+	+	+	+			+	+		+	+
Myrtaceae	Guava				+								
Rosaceae	Apple					+							
Peach		+	+	+							+	+	
Plum													+
Nectarine		+	+										
Vitaceae	Grape				+								
Leaves/bark													
Avicenniaceae	*Avicennia marina*	+	+	+	+	+	+	+	+	+	+	+	+
Salicaceae	*Populus* spp.	+	+	+	+	+	+		+	+	+	+	+
Bark (various)		+	+	+	+	+	+	+	+	+	+	+	+

Jones & Augee, 2001; p.50)

4.2 Conflict & Coexistence

4.2.1 Shared History

Aboriginal rock in sandstone caves around Cape York of FF and their inclusion in Dreamtime stories (Rose & Tsumura, 2010), suggests Indigenous groups respected FF as sacred (Richards & Hall, 2012), while other tribes in NSW and NT appear to have used them as a food source (Vardon *et al.*, 1997). European settlement brought fears and prejudice towards bats and FF alike. Bats throughout history are often referred to as the dark and evil creatures of the night. An article in the 'Nature' section in the newspaper Border Watch, (1879) published on 4th October 1879 in South Australia, uses terminology such as puzzling, strange, weird, enigmatic and grotesque. Such depictions and other war-orientated language were very typical of that era. News articles found from between 1890-1960 include mostly complaints from fruit growers in rural NSW and Queensland, with plans of eradicating by shooting and scalping (Land, 1952; Bowral Free Press and Berrima District Intelligencer, 1890; Clarence and Richmond Examiner, 1907). In 1928 Francis Ratcliffe arrived from England to survey the damage FF were causing to fruit crops (Richards & Hall, 2012). Ratcliffe (1932) concluded the economic damage was not significant. Like many researchers after him such evidence remained largely ignored and fruit growers continued to take matters into their own hands. Up until 1986 GHFF were considered agricultural pests, which meant there were no restrictions on mortality rates. As orchards likely encroached on FF native habitat they instead started to feed on the abundant supply of fruit trees. This resulted in farmers electrocuting, shooting and scalping thousands of FF. In the 1920's 300,000 FF deaths were recorded under the bounty system alone (Rose & Tsumura, 2010).

In 1986, GHFF were listed as a protected species, and shooting became restricted to licence holders (Waples, 2002). After a significant drop in populations had been recorded, GHFF were listed as a Threatened species in 2001 under the NSW Threatened Species Conservation Act 1995 (Eby & Lunney, 2002). It wasn't until 2008 that shooting became illegal in all states, but was reintroduced in Queensland in 2012 (Abdul Aziz *et al.*, 2016). Astoundingly, despite farmers extensive success with netting their crops, culling is still used as a form of management (Abdul Aziz, *et al.*, 2016).

According to an excerpt taken from the Australian Town and Country Journal (1898), there have been sightings of FF in Sydney since and possibly prior to 1898

> *"During the warmer months these bats simply swarm in the neighbourhood of orchards, and may even be seen, or rather heard in great numbers in the city of Sydney, to which they are attracted by the luscious ripe fruit of the native fig tree."* (Australian Town and Country Journal, 1898).

FF's have been increasing in towns and cities since the 1980s (Van der Ree *et al.*, 2006), which has lead to increasing complaints of noise, smell and disease concerns. Residents often tolerate smaller camps, but conflicts can arise when camps reach upwards of thousands (Dengate, 2014), as is sometime the case with maternity camps during mating season (Parry-Jones & Augee, 1992). The media has a habit of exaggerating such issues, by using terminology such as rambunctious, deafening and stench (Dengate, 2015; Marks, 2015). These old prejudice and a lack of knowledge have unfortunately led to problematic decisions. Leaving FF caught between the pressures of habitat loss and shooting in rural areas and the risk of electrical wires and dispersal attempts in urban environments. To better understand the effect these pressures were having on FF populations the Royal Zoological Society BATWATCH was established in 1986. The Ku-ring-gai Bat Conservation Society (KBCS) was also formed in 1985 to educate residents about FF and manage habitat restoration in the Ku-ring-gai FF reserve in northern Sydney (Larsen *et al.*, 2002).

4.2.2 Traditional Approach

As a result of increasing urbanisation, FF have become the victim of residential complaints, including noise, smell and fears of disease. In the hope of appeasing complaints by locals, councils too often attempt to relocate colonies of FF. Most dispersals are characterised by loud noises, flashing lights and smoke which are played for 30-120min, in an attempt to force FFs out of one area and into another (Roberts *et al.*, 2011).

One of the more famous dispersals was that of the Royal Botanical Gardens in Sydney, in which exotic yet vulnerable heritage trees are planted. These were home to upwards of 6000 Flying-foxes and was considered a maternity camp (Richards, 2002). Male Grey-headed Flying-foxes tear leaves from branches to mark their territory (Richards & Hall, 2012). To preserve these trees, multiple ongoing million-dollar dispersal ventures at the Royal Botanic Gardens were attempted in hopes of dispersing the grey-headed FF. After repeated effort, the Botanical Gardens managed to disperse a significant portion of the population, though about 3,000 still remained (Roberts & Eby, 2012). Not surprisingly the FF moved to neighbouring camps, such as the Balgowlah camp at Burnt Bridge Creek in Manly, which increased in size soon after the dispersal in 2012, as confirmed via

radio tracking in 2015 (Martin, 2015). It is evident that dispersal of adjacent and nearby sites have direct correlation to the population of Grey-headed Flying-foxes in the Balgowlah Camp.

In each case the FF become sufficiently disturbed and distressed, causing extreme fatigue and stress to the animals. As maternity camps are usually the greatest in number dispersals often take place during mating season when numbers are greatest. This results in detrimental impact to pregnant or nursing mothers and substantial infant mortality (Thiriet, 2005). These highly unethical attacks on maternity camps have been recently considered and relocation attempts are now only allowed outside mating season, though some council's choose to ignore such rules violating their dispersal licences (Thiriet, 2005). Furthermore surveys such as Ballard (2005) found that a majority of negative attitude towards FF came from fruit growers as a result of destruction to their crops, whereas urban residents had a relatively positive attitude towards FF. Dispersal attempts may only worsen the issue farmers have with FF if cities and town continue to try and relocate these creatures. Just as shooting thousands of FF had minimal effect on reducing conflict, it is unlikely that dispersal attempts will be any more effective.

From studies such as Roberts *et al.*, (2012) and Webb & Tidemann, (1996) it is evident that GHFF act as a single fluid population. Therefore such relocation attempts on localised groups of FF have proven to be short-sighted and ineffective. FFs that were not present during the initial disturbances are likely to occupy roost sites in subsequent months or years (Roberts *et al.*, 2012), similarly, those that were present often return soon after dispersal methods have ceased (Thiriet, 2005). On numerous occasions FF return to their original colony, and in some cases have established new roots in worse locations (Roberts *et al.*, 2011; Thiriet, 2005)**.** Upward of $400,000 of taxpayer's money can be spent on these failed efforts (Roberts *et al.*, 2011), which only seek to threaten the welfare of these native, and endangered species. Money would be better spent on minimising conflict as opposed to temporarily displacing it.

4.2.3 Attitudes & Opinion

More often than not, individuals actively communicate their opinions on a subject when they hold a negative point of view towards it (QPWS, 2001). Though complaints of FF noise and smell are continuously brought up in discussions, it seems this negative view is not representative of all stakeholders. A study conducted in 2001 by the KBCS on the Gordon neighbourhood surrounding Ku-ring-gai FF reserve in Sydney managed to successfully record the opinion and attitudes of 78%

respondents. They found that living near the FF colony resulted an overall attitude of 56% positive, 11% negative and 32% neutral. The same study found that 74% would choose to live near the colony again and 71% agreed 'living near the colony was a source of interest and enjoyment'. Though the Gordon community may be one of the few examples of FF and humans living in harmony (Larsen *et al.*, 2002), it highlights the need for, and opportunities in, coexistence.

Understandably it is council's duty to comply to residential desires. Yet these desires may vary based on individual circumstances. Ballard (2005) did a comparative survey between fruit growers and the general public, on their attitudes and opinions of FF. Most commonly, individuals who have had frequent interactions with FF, tend to dislike FF to some degree. For fruit growers this is not surprising as FFs are a potential threat to their livelihood, but for urbanites the dislike of FF is derived from a less consequential source. Larsen *et al.*, (2002) survey, revealed the closer public residents lived to a colony the less tolerant they were of noise and smell from FF. Parry-Jones & Augee (1991), Eby (1995) and Law *et al.*, (2002) predict this attitude would likely get worse if people remain uninformed of FF colonies nearby. Therefore Smith (2002), Eby (2002) and Ballard (2005) suggest informing future residents within range of a local FF colony, before they decide to buy or rent a house. Some might fear that this would de-value the property, but for others it has the potential of appealing to those that find living near wildlife a source of enjoyment. Larsen *et al.*, (2002) found that residents appreciated being informed of a FF colony nearby, because it allowed them to accept its presence before moving in.

4.2.4 Education

Education continues to be a problem surrounding FF. Ballard (2005) found that a common misconception among fruit growers was that FF preferred commercial fruit to native species. Parry-Jones & Augee, (2001) found this was not the case, rather FF occasionally fed on fruit when other food sources such as *Ficus* spp. and *Banksia* spp. were low. This belief that FF preferred introduced fruit species lead to the assumption that they were not important to native forests as pollinators and seed dispersers. Ballard (2005) also found that both fruit growers and the general public were unsure of the diseases associated with FF, or why conservation was even required. Likewise Larsen *et al.*, (2002) found that people were unclear of basic FF ecology, such as the reasons why FF populations fluctuated and how diseases were transmitted.

Ford (2002) did a study on the attitudes of primary-school aged children before and after an education program on bats. As hoped, the education program had a positive effect on the attitudes

of the children, shifting negative views to more positive ones. The drawings in Figure 2 show students depictions of bats before the programs, while the drawings in Figure 3 are drawn by the same students after learning about bats. Whether this viewpoint continues into their adulthood is yet to be determined. Ford (2002) highlights the consequence of misinformation, and how education can play a critical role in generating social norms which express desired attitudes and behaviours, in order to reshape them.

Figure 2. Examples from student drawings in Quiz 1 (Ford, 2002; p.155)

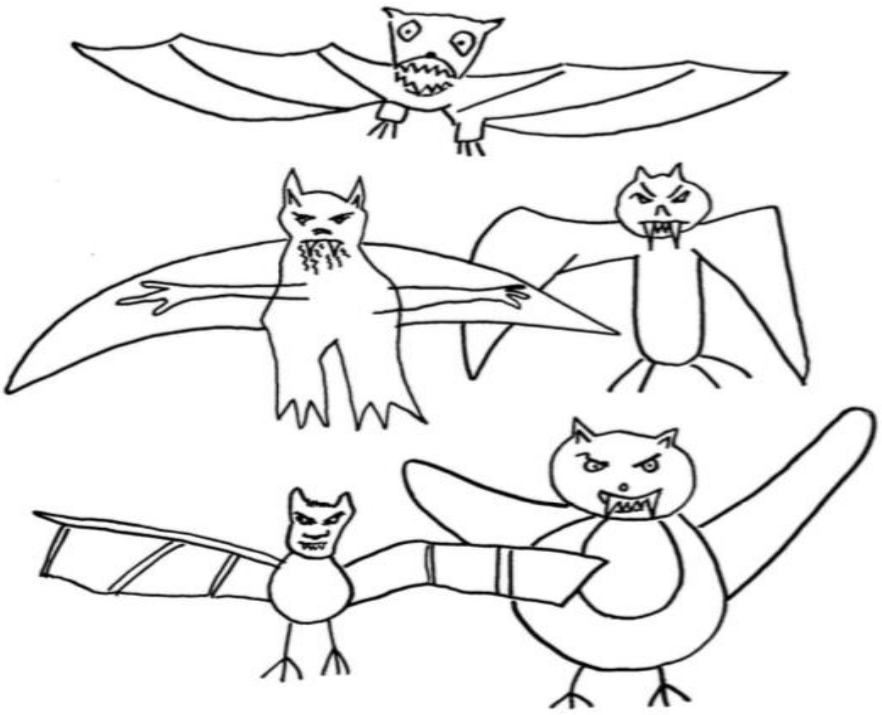
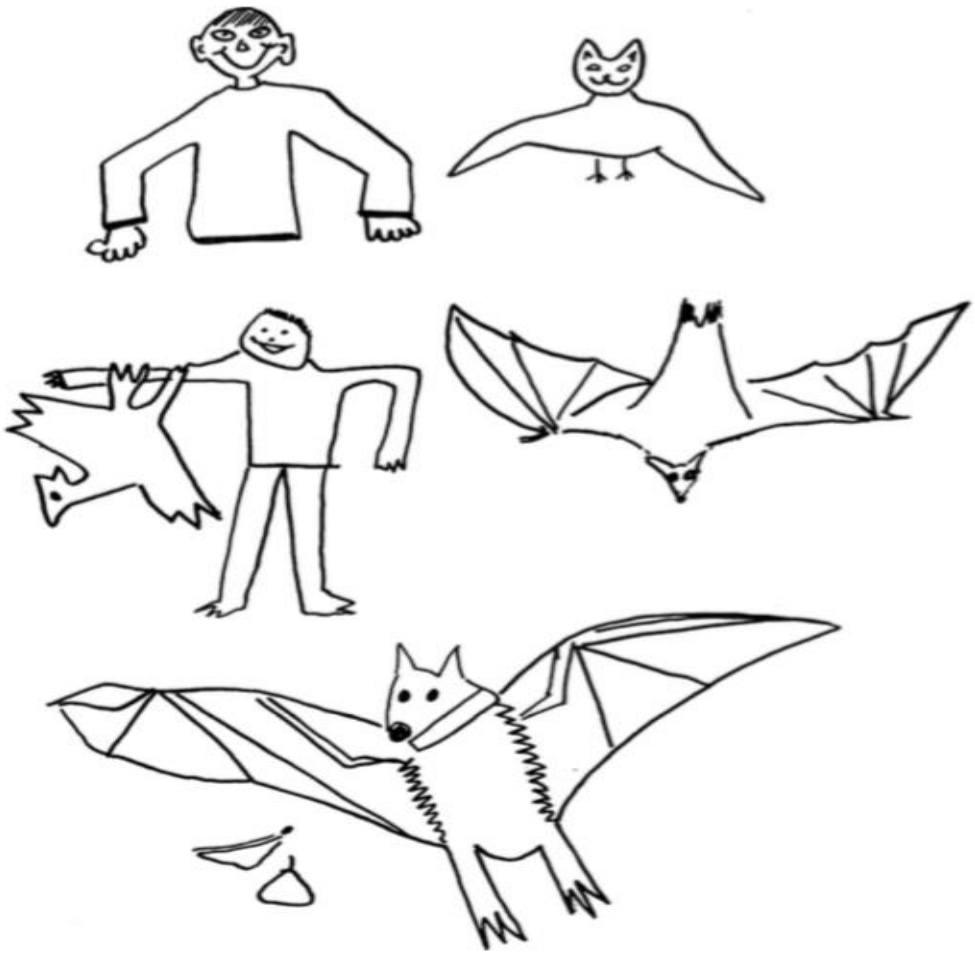


Figure 3. Examples from student drawings in Quiz 3 (Ford, 2002; p.156)



5. Burnt Bridge Creek - Balgowlah, Manly

5.1 Site Background

Manly Environment Centre (MEC) is responsible for the management of Burnt Bridge Creek in Balgowlah, Manly. This zone is located directly ahead of the crossroads between Balgowlah Road and West Street and is adjacent to the Burnt Bridge Creek Deviation. This vegetated area stretches horizontally along Balgowlah Road itself and the site can be accessed by foot.

Within this site, 1.8 hectares (18000m^2) of appropriate roost habitat is occupied by flying-foxes, in which 0.59 hectares (5900m^2) are identified to be seasonally occupied by FF (MEC 2016). Burnt Bridge Creek, a freshwater creek flowing towards Manly Lagoon, runs through this area, as well as a bike track connecting to the Burnt Bridge Deviation. The area consists of Sclerophyll forest, which includes an assortment of eucalypts, oaks and banksias, such as the *Banksia integrifolia* ('Old Man' Banksia) and the *Allocasuarina littoralis* (Black She-Oak). However, a large proportion of the remaining vegetation consist of invasive plants and exotic weeds, a particularly problematic tree is the *Erythrina X sykesii* (coral tree)(MEC 2016). he surrounding Balgowlah area is home to around 7500 residents and is comprised of mostly residential zoning (ABS 2011).

At Burnt Bridge Creek the FF colony now roosts in the invasive Coral Trees. The colony mainly consists of Grey-headed Flying-foxes, but there have also been a few sightings of Black Flying-foxes and Little Red Flying-foxes (MEC 2016). The Flying-foxes were first recorded roosting in Balgowlah via the use of radio tracking in 2010 (Ecosure 2016). Prior to 2012, the highest amount of resident FF recorded at Balgowlah was approximately 1100. This number has since been elevated to 6000 FF and is increasing (Royal Botanical Gardens and Domain Trust 2015).
Within the last decade, a significant number of complaints have been lodged to Manly Council by adjacent landowners and residents. Common complaints include physical annoyances, such as foul odours, health concerns and the possibility of indirect financial costs such as property deterioration and devaluation (MEC 2016), though only 20 such complaints have been lodged over the last few years (MEC 2016). Despite these disapprovals, it is notable that the wider Manly community are willing to support the conservation of the habitat and the FF as a species (Ecosure 2016).

Habitat regeneration around FF roostings are limited due to licence and certificate complications (s132C) which restricts bush regeneration actions near FF sites (Ecosure 2016). Despite this, the

council has managed to successfully restore much of the site. Roost suitable trees including oak and Banksia, were planted to provide additional habitat for the FF. These trees are expected to grow to full height within the next three years, and provide an estimated 25% of roosting area. Other than management procedures for site revitalization, steps were put into the place to inform locals of the FF populations, such as placing in signages for demarcation of FF presence and creating narrow (up to 10m) mowed surfaces as buffer zone between adjacent properties and the FF roost trees.

5.1.1 Stakeholders

- Residents and owners of surrounding properties
- Passerbys and cyclists utilizing the pre-existing footpaths
- Conservationists and park-users
- Council and NSW Office of Environmental Heritage
- Other taxpayers
- Environmental Legislator
- The Environment

5.1.2 Council Effort & Community Engagement

Past council effort on active community engagement maintenance and restoration of the site have been consistent. A plan of management was created by the Manly Council in 1996, and has brought in funds in hopes of controlling weeds and replanting native species as well as raising environmental awareness among the local community. Physical measures such as street sweeping initiatives to remove pollutants, educational signage (Figure 4.) and the upgrading of relevant paths were implemented to improve environmental health (MEC 2016). Another restoration project initiated by the Manly Council now in collaboration with the Warringah council, the Burnt Bridge Creek Integrated Restoration Project, aims to conserve the local riparian / catchment habitats in the passing creek by regulating stormwater flows using a constructed bioretention basin.

In light of the increasing numbers of FF making Balgowlah their home and in addition to mounting levels of community awareness. Ecosure's management plan, with additions, has been proposed to guide further action. These improved measures include:

- Appropriate maintenance of grass buffers.
- Continued restoration effort by tree plantation and weed removal.
- Obtainment of license 's91' for continued and efficient maintenance.

- Monitoring local LGA FF populations.
- Further community education programmes for better understanding.

As well as many ongoing additions as situations permit (McPeake Pers. Comm 2016).

Figure 4. Educational signage on GHFF habitat along Burnt Bridge Creek pedestrian access path (Hollingshead, 2016)

6. Case Studies: Council, Community Engagement & Flying-Foxes

6.1 Isaac Regional Council, Queensland

6.1.1 Background

Isaac regional council covers 58 862 km^2 of land in East Queensland reaching from the coast to inland plains. In 2014 Isaac Council won the Government Communications Australia Award for their FF community outreach program. Little Red flying foxes (*Pteropus scapulatus*) had set up colonies in the townships of Middlemount (camp of 50,000) and Moranbah (camp of 30,000). The surrounding land is used for mining and farming, making the oasis of trees in local townships an ideal location for FF to roost.

Isaac council decided to go ahead with dispersals in September 2014 but understood the need to have a high level of community engagement and cooperation. Human health risks were of particular cause for concern as the Moranbah camp was located along a school route. Thus increasing the chances children would come into direct contact with FF. The community became hostile and started their own action group inviting an external lobbyist, before the engagement plan could be implemented.

6.1.2 Community Engagement Program

Initial Contact

Isaac council set out to implement a two-step approach, a community awareness program, followed by a community engagement program. An initial meeting gave the public an opportunity to voice their concerns and offered the community reassurance that the council was prepared to listen. The council provided the community with an allocated FF contact. A local community officer with existing connections to residents. From this initial meeting, an instant shift in community energy and opinion was noted as council had proven that they were prepared to listen to the public and respond to any situation. The public felt they were now a part of the solution by having an active say and part to play in the dispersal process.

Media

The media was identified as a key stakeholder and council provided them with timely media releases, statements and interview opportunities. Over a four-month period, 24 news articles on the FF appeared on television, radio and in newspapers. This provided assistance to remediate community backlash. Some residents had begun beeping their car horns as they drove past the camps, attempting to drive them away. This caused issues for the official dispersal processes and therefore it was imperative that the council were able to inform residents about the implications of their actions. Due to the good relationship with local press several newspaper articles were released. A media release entitled, 'Motorists disrupt FF dispersal' was published and the article 'No beeping at the bats' (Daily Mercury, 2014) which appeared in local press also received radio and social media coverage. Residents changed their behaviour and the issue was resolved.

The appearance of ManBat *"batman's bearded doppelganger"* (Isaac Regional council, 2014) on social media brought humour to an otherwise traumatic situation. The concept was championed by the press and locals and the hashtag #manbat began to circulate online. Social media was seen as an effective communication tool for time sensitive information and for gauging general opinions and shifts from the community.

Campaign Roll Out

The council enabled a two-way feedback process during the campaign with informative handouts, media releases and spokespeople promoting consistent key messages. The communication tools and the associated dissemination methods can be seen in Table 3.

Table 3. Isaac Regional Council - FF community engagement tools and dissemination methods (Isaac Regional Council, 2014)

Communication Tool	Dissemination Method
Information sheet 'Flying Fox Management at Home'	Advertised in six community newsletters Emailed to regional distribution lists Displayed on community noticeboards Promoted on IRC's Facebook page Available IRC Website Displayed at IRC Customer Service desks (nine) and IRC Libraries (nine)

Media Release ‘What you need to know for flying fox season’	Published in print and online
Facebook campaign ‘Flying Fox Facts’	Five ‘Flying Fox Facts’ linked to Community Radio (4RFM)
Radio campaign Community Service Announcement - generate awareness of FF season and direct residents to the website	Moranbah Website
Information sheets Developed to address community concerns with ecology agents Ecosure and EHOs ‘Flying foxes and children’ ‘Flying foxes and horses’ ‘Flying foxes and dogs, cats’ ‘Flying foxes in residential areas’ ‘Flying foxes and rainwater tanks’	Available on IRC’s FF Webpage Promoted via Social Media ‘Flying Fox Facts’ Used and displayed at engagement opportunities including the Moranbah Home Show
Website Webpage specific to FFs including the above information sheets and complete overview of FFs, myths, virus’ and important health information Supporting Visual Components - website banner, Facebook banner, library multi-screen displays	IRC Website Promoted via Social Media ‘Flying Fox Facts’
Community Letter To all affected residents, to support them and encourage compliance (not disturbing the colony)	Door knock and letterbox drop by IRC EHOs (engagement and monitoring frequency increases with affected residents)
Community Notice From local Councillor to support and update residents on the situation	Emailed to community list Shared onto local Facebook noticeboard Displayed in hard copy at local office.
Key Message Script Provided to all staff with community contact, to support any complaints	EHO Staff Customer Service Officers

	Place Officer for Middlemount Library Staff Outdoor Staff
Environmental Health Officers Regularly monitoring and engaging with affected residents, referencing key messages	Engagement commenced early and the EHOs maintained good rapport with affected residents in the early stages of the migration. It was important Council was seen on the ground. Due to limited staffing resources and distance to travel to Middlemount, this was a considerable effort

6.1.3 Key Strategies & Measures of Success

Isaac council put the success of the cost-effective project down to communicating consistent key messages during a customer focused campaign. Council enabled a two-way community engagement model throughout to manage information integrity and effective workflow between stakeholders. The council harnessed the previously negative community attention and used it for effective engagement. This extended to the high level of media interest surrounding FFs which was used as an effective tool.

Council were able to use social media to gauge public response and interaction. The program also received praise from external stakeholders. Ecosure, the environmental consulting company for the project, went on to use the model for future FF projects. While the IRC environmental services department stated that *"face to face contact is very important, possibly the most effective tool in the flying fox management process."* (Isaac Regional council, 2014)

6.2 Eurobodalla Shire Council, New South Wales

6.2.1 Background

Eurobodalla Shire Council covers an area of 3,428 km² in southeast New South Wales. Land use includes residential, recreation, farming and national park. Grey headed FFs seasonally roost at the Water Gardens in Bateman's Bay and in April 2016 numbers had peaked at 100,000. This was a large increase as compared to previous recorded numbers of 20,000 in 2015. Council hired

Ecosure to create a report assessing key issues and recommendations. Problems identified included power outages caused by FFs becoming fatally entangled in power cables, water quality issues as well as smell and flora and fauna imbalances.

6.2.2 Recommendations

Ecosure (2016) recommended that the following measures were implemented to help aid the cohabitation of FFs and residents.

General Recommendations

- Adequate management of power sources to avoid entanglement of FFs
- Incentive scheme to make FFs a tourist attraction with the financial benefits being reinvested back into the impacted community.
- Property modifications and subsidies for residents.
- Creation of education and media opportunities.
- Increasing vegetation buffers to prevent spillovers from camps into residential areas.
- Investigating potential land for creating alternative FF habitat – although this is a risky option as there is no guarantee the FFs will use it.

Recommendations for impacted residents

The following key impact reduction strategies were suggested for communication to local residents.

- Create visual/sound/smell barriers with fencing or hedges.
- Plantation of fragrant vegetation that do not attract FF.
- Cover vehicles, structures and clothes lines or remove washing from the line before dawn/dusk.
- Move or cover eating areas (e.g. BBQs and tables).
- Install double-glazed windows, insulation and use air-conditioners when needed to reduce noise disturbance and smell associated with a nearby camp.
- Follow horse husbandry and property management provided at the NSW Department of Primary Industries Hendra virus webpage (DPI 2015).
- Turn off lighting at night which may assist flying-fox navigation.
- Consideration for removable covers for swimming pools and ensure working filter and regular chlorine treatment.
- Removable covers for boats, or other measures to deter flying-foxes landing on masts.
- Management of rainwater tanks, including installing first-flush systems.

Dispersal

The report warned against a disruptive dispersal as there is a high risk that the FFs would return the following season and it would cost more than 250k. There were also concerns for the health of the FFs, disruption to residents and pets due to noise, community backlash and an increased chance that FFs would collide with aircrafts.

6.2.3 Politics & Council Action

Despite the Ecosure report advising against it the council controversially went ahead with a dispersal. This may seem a questionable decision as a council report had previously stated;

> "*Dispersal activities have unpredictable outcomes, are very costly, require ongoing commitment and maintenance, are often not successful, and rarely achieve desirable outcomes for all stakeholders."* (ABC, 2016).

However, at community consultation meeting, conflict peaked. The Minister for the Environment attended and spoke in favour of a dispersal.

> *"The message from the community is clear — the council must act. The message from the state is clear — we will let you act. The message from the Commonwealth is clear — you have freedom to act and you must act."* - Environmental Minister Greg Hunt (ABC, 2016).

Despite this, even if the council had wanted to act, GHFF are listed by the Commonwealth and NSW Governments as a vulnerable species which would have prevented dispersals from being put forward. Nevertheless, the minister had a solution for the problem -

> "*We will give an exemption through the national interest exemption process so the council can take action.*" - Environmental Minister Greg Hunt (ABC, 2016)

The dispersal plan is estimated to cost $6.2m over three years with NSW Premier Mike Baird's allocation of $2.5 million of public funds towards the cost (Northern Star, 2016). The move has been slated by Evan Quartermain, Senior Program Manager at the Humane Society International Australia,

> "*We have an absurd situation where in effect the Commonwealth has delegated responsibility to the States, who have in turn delegated responsibility to local councils, who then respond to a handful of the noisiest individuals."*

Mr Quatermain also expressed concern for the well-being of the FFs stating that,

> "*Councils are predominantly proceeding to harm the flying-foxes, spending vast amounts of public money and all for the sake of a process likely to fail. So we end up spending millions of dollars to stop the bellyaching of a few individuals, funding that should be spent on recovering the species, but of course never has been."* (Northern Star, 2016).

In June 2016 the council began the dispersal process. Many of the FFs left due to their natural migration patterns and those which remained were relocated via the dispersal to a golf course within the local area. The council have accepted that the FF are likely to return next year and have therefore tried to create vegetation buffer zones to prevent camps from forming too close to residential properties. The FF located at the golf course would continue to impact residents during night time fly outs and foraging.

6.2.4 Community Engagement Program

Council engaged the community early, with contact made as the FF began to camp in the local area. This prompt engagement, combined with one on one door knock consultations meant the community felt they were being heard and involved in the decision making process from the start, which prevented negative attitudes from building. The council also offered practical assistance to help residents cope with the impacts of living near FF camps. Properties which are located within 250m of the camp are offered free rental of high pressure cleaning equipment car covers and clothesline covers, and assistance with removal of Cocos palms from their yards. The council website also offered fact sheets on FFs and human health, dispersals and FF facts. Council provided a timeline of all FF meetings/ activities and have updated this regularly so residents can track progress and research history.

6.3 Cairns Regional Council, Queensland

6.3.1 Background

Cairns regional council covers an area of 4,135 km² on the northeast coast of Queensland. Land use includes farming, residential and tourism and includes 44 spectacled FF roosting sites within the area covered by Cairns Council. The numbers and locations of camps change with each seasonal migration however there is only one permanent camp at the Cairns city library. Six camps within the region are listed as being nationally important.

6.3.2 Community Engagement

The council provides information fact sheets on their website and formed a FF advisory committee. The committee meet quarterly and the public are allowed to attend. Meeting minutes are uploaded to the council's website for public access. The committee are responsible for interpreting research material for community education programs, organising awareness education activities and events, forwarding adaptive management approach reports to council and for making recommendations for all matters concerning FFs within the region. Each education event is evaluated at the following meeting to establish key outcomes, successes, failures and areas for improvement.

Current and past community engagement strategies

- Flying Fox Summit 2015
- Sponsorship of Cairns Bat Festival
- Bat Chats at the Cairns City Library held during school holidays
- Signage at the Nursery Tree Roost - Cairns City Library
- Bat Branding – 'living under one sky' (Figure 5.)

Figure 5. Cairns regional council Bat Branding - 'living under one sky'

(Cairns regional council, 2016)

Future Engagement Considerations

The following community engagement opportunities were identified at meetings held by the FF committee:

- FF information to be distributed to residents new to Cairns and available to existing residents.
- Development of a FF mobile phone application.
- Development of a Natural Heritage Trail for Cairns with a mobile phone application.
- Establish a FF viewing platform.
- Tourist Guides.
- Wildlife careers and processes.
- The importance of having a council marketing team member present at meetings.
- FF 'Fly-out' talks at the City Library.
- Live bat for display and educational purposes.
- Signage in the local area to be adapted seasonally. i.e.: pup/ baby season.

6.4 Ku-ring-gai Bat Conservation Society

Ku-ring-gai Bat Conservation Society (KBCS) was established in 1985. It's initial aim was to protect a maternity FF colony at Gordon, on Sydney's North Shore. The project was a success and the organisation continues its fight to protect not only FF, but all species of bats within Australia. Members of the public are invited to join the society and are able to make donations. KBCS also

provides a research grant to support students who make contributions to the study of bat biology or ecology.

KBCS focuses on both conservation and education, with its' website operating under the name "Sydney Bats". It offers a wealth of information on bats themselves and advice for the general public should they come into direct contact with bats. There is a page dedicated entirely to children which includes a bat word search, join the dots and other activities. Posters suitable for classrooms are also featured alongside bat songs and poems. The site provide numerous links to peer-reviewed papers, scientific data and related website links Australia-wide.

The KBCS website houses three video links which can be used for educational purposes. The "Bat Rap" provides an educational and musical introduction to flying foxes and the ecosystem services which they provide. The site also features a short documentary entitled "Hanging in the Balance." This educational and entertaining film won the best film award at the 2014 Cause Film Festival. Finally, in a TEDx film, KBCS Chairman Tim Pearson gives an emotive talk on FF. He emphasises traits which are similar to those of humans, making FF relatable. The final slide displays the consequences of life without FF, picturing a woman in China hand pollinating trees due to species loss.

6.5 Case Studies Summary

Early community engagement, particularly when FF first arrive in an area, can shape community attitudes, beliefs and opinion from the onset of the engagement process. Early contact with council also enables residents to feel connected rather than alienated. Two-way feedback engagement models have proved crucial for enabling the community to feel that their voices are being heard rather than leaving negative opinion to build up, which often leads to counteractive community action. By allowing residents to be involved in the process, they then become a part of the solution which can shift attitudes in alignment with the community plan. Key messages from council and its associated partners need to be consistent in order for the public to believe in their value. Media energy also needs to be harnessed and used to communicate these key messages. Timely communication is an important part of the process with social media offering real time updates and opportunities to gauge community opinion. An online updated schedule of council's actions and plans allow residents to be informed without the need for constant contact. By providing practical solutions such as the availability of pressure washers, car and clothes lines covers, councils are

seen to be taking resident's needs into consideration alongside those of the FFs. The option championing FFs and showcasing camps to tourists offers an opportunity to boost the local economy and fund rebate schemes while educating residents.

7. Cost-Benefit Analysis

Possible solutions are plentiful but all come at a significant cost, both economically and for the environment. Appropriate cost-benefit analyses will not only reduce costs and regulate impacts, but could also help maintain the FF habitat.

7.1 Microclimate Management

Commented [3]: Should we change this title? Do people know what microclimate management is?

Much work and thought has been invested in the regeneration of the FF site (Ecosure 2016). However, there are other cost-viable solutions in microclimate management that could be used to improve residential satisfaction. Ecosure suggests the plantation of fragrant plants along mowed buffer zones between residential housing and the adjacent housing, which would override unpleasant smells (MEC 2016). Some of the plants native to the 'Sclerophyll' forest type include *Melaleucas* and *Banksias*, both flowers of which are fragrant. When planted will not be considered an invasive species and can be considered to be part of the natural rehabilitation process when appropriate permits have been obtained.

The Manly Council, in their statement for conservation, have also proposed to create a small bioretention cell at the foot of the camp to be used as a stormwater runoff point (Ecosure 2016). It is located at a very optimal position that utilizes the incline of the hill and should be used in conjunction with the waterways to effectively clear FF smells. Meanwhile in terms of physics, Fick's first law of diffusion describes the transmission of particles through air and liquid. Therefore using the flowing creek as a medium for foul smell removal becomes a viable choice. By utilising this science, it is therefore possible to eliminate the expenses associated with ventilation and air conditioning.

Table 4. Hydromodification: Cost-benefit analysis of deepening Burnt Bridge Creek

Item	**Cost**	**Comments / Implications**
Labour	$50/hr, $5000 per	Price may vary. -

	100hr maintain	
Engineers	- -	Council provision, price may vary
Machinery	~$500/Session	Access to site, may cause damage to vegetation and habitat depending on calibre
Materials	$1000	Soils and riparian treatment
Maintenance	Incl. from labour cost	Price may vary.
Monitoring / Testing - water etc.	$500	Could have consequence for drainage, natural habitat, benthic fauna, downstream impacts, turbidity, sedimentation, interference with gross pollutant trap

Planned routine mowing of certain patches of tall grass could serve as a visual buffer between adjacent residents and the nearby colony. Ventilation, which is facilitated by the nearby Burnt Bridge Deviation through road and Balgowlah road could be effective in removing smells. Wind channels from the adjacent roads could be utilized to use the Venturi effect. The Venturi effect is a physical phenomenon where fluids passing through a narrow pass experience a drop in pressure but increase in velocity. Remarkably, this phenomena could be reengineered to address odour issues in Balgowlah. By rearranging trees (fragrant species included) into a “V” formation (Figure 6.), a bottleneck, or narrow channel, could be created, ultimately generating a venturi response. The cost from this step would mostly come from the hiring of suitable gardeners and maintenance personnel. A good choice of tree for fragrant display is the Banksia Integrifolia - native to the area.
Using vegetation and landscaping solutions to create wind tunnels and river diffusion, although unique and innovative, may not be practical based on the extensive costs of these endeavours, and their experimental nature.

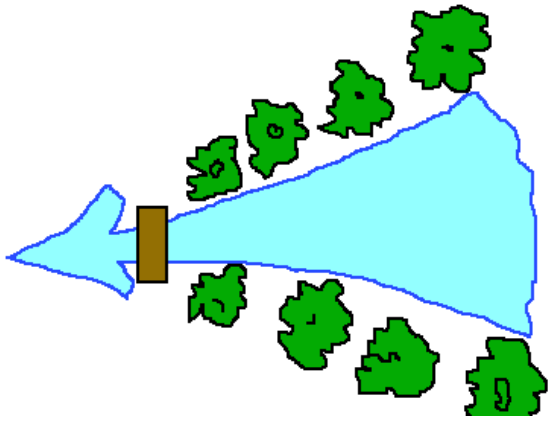


Figure 6. Venturi Effect - realigning trees at Burnt Bridge Creek to eliminate associated odours (DNR Louisiana n.d)

7.2 Household Measures

Other than on-site management plans, council has also shown interest in subsidizing households in the vicinity of the camp with items and skills that may help cope with the nearby colony (Ecosure 2016).

As mentioned, the noise pollution associated with FFs is cause of major concern for residents, (In) some cases their calls can reach 90 decibels in loudness, the equivalent to jackhammer in operation (Ausbats n.d.). Double-glazed windows are the best option for keeping out noise, and require very minimal maintenance processes. In fact In most cases, the maintenance of such double-glazed windows simply involves cleaning and lubrication of locking mechanisms and seals. The image below depicts the extent of the Balgowlah roosting camp as well as an estimated range of dissipation for bat calls. The Burnt Bridge Deviation runs adjacent to the FF camp, and associated residents. This produces traffic related noise of approximately 60bd (Maryland Roads n.d.). Therefore, complete noise reduction down to acceptable night standards (15db) is not necessary. Rather, standard 20mm air gap double glazing windows, which provide up to 35 db of noise reduction, are appropriate for this site (Tadeu et. al 2000).

The projection of 100 dissipation was calculated from the laws of sound attenuation through distance at 2500 millibars (Wolfram Alpha). It was found that 40db can be reduced to 50db at around 100 metres (Figure X)

.

Figure 7. Balgowlah GHFF noise extent - 100m buffer

37 households in the immediate 100-metre radius are expected to be affected by loud calls. All of the houses have an estimate of one facade facing the camp, which accounts for 37 windows to be fitted. Predicting an average of 3 windows per surface and an average of $1000 from aggregate, the approximate cost would be $111000. Comparatively, this is an expensive cost, but is still considerable due to the low maintenance and high durability.

According to Ecosure's report, covering outdoor equipment such as BBQ, grills and seating is an effective method of reducing fecal contamination from the FF, as it deters them from landing.This is the cheapest solution, as it does not involve costs associated with installation, or complex land clearance, it does however require recurring maintenance.

7.2.1 Double Glazed Windows

The installation of double glazed windows has proven to reduce noise impacts experienced by residents living within close proximity to a flying fox camp ((Tadeu et. al 2000). Although the baseline noise level from the highway at Balgowlah may exceed those produced by the colony, it is important to remember that these peaks may occur at different points during the day. It is expected that the volume of traffic would be at its highest during the morning and afternoon rush hours which may not coincide with FF noise peaks. Noise levels from FF will also vary between seasons. Camps are generally noisiest March – May (Parry-Jones & Augee, 1992) during mating season. The Australian Wildlife Society (2016) recommends that residents who are severely impacted by noise should consider arranging their holidays to coincide with these months. More in depth baseline data collection of both noise levels and community opinion is required at Balgowlah to establish if double glazing would be effective. A community survey would help establish if residents are negatively impacted by noise and this would also offer an opportunity to gather views on other areas (such as smell and perceptions). The roll out of a survey would provide a chance to inform residence on FFs, and feedback, consultation and assistance services. An evaluation of this data could be used to establish if the initial outlay costs of installing double glazing would be offset by the benefits reaped by the community.

7.3 Education Strategies

Education programmes that project desired social normative behaviour enable public awareness of issues and a change in attitudes (section 3). As such, the development of educational programs, which incorporate FF site visits and interaction (tangibility) would enable the development of FF coexistence as the new norm. This would generate a generational appreciation towards FF and potentially decrease the number of complaints linked to them. Schools within the Northern Beaches could take part in these FF programs, to ensure district wide “norms” of FF coexistence are established.

7.3.1 Interactive Programs

As per council request, sings are located along the access paths of Balgowlah Burnt Bridge Creek (Figure 8.), providing information on the GHFF camp. The ‘Threatened Species Day’ also brings

much light to the plight of FF, however efforts towards public awareness need to be improved. The development of a FF mobile application with engaging peer to peer activities could be used during field trip events and educational tours to bring an element of gaming and excitement to FF.

Figure 8. Balgowlah GHFF information - signs located along the access paths of Burnt Bridge Creek (Hollingshead, 2016)

The immediate measurable costs for creating such initiatives include the development of peer to peer engagement components (more difficult to plan than traditional theory based courses), and theoretical and practical content in relation to FF. Successful strategies from MECs collaborative Kids, Companies and Creeks program can be used to guide this educational program. Alternatively, FF programs could become an additional component to Kids, Companies and Creeks, saving time, money, and resources during the startup phase. From a cost-benefit analysis perspective, the costs associated with design and implementation of these educational programs are minimal compared to associated benefits - greater instances of engagement, improved environmental awareness, 'spillover' actions into other environmental fields, and most importantly acceptance and appreciation of the role of FF in the environment.

A study conducted by McCalley (2002), also observed the role of goal setting and feedback in producing pro-environmental behaviours towards household energy consumption. McCalley found that feedback alone was ineffective in producing a behavioural response towards energy use/savings, however when used in conjunction with goal setting, the effect increased by 20%.

Further still, when individuals were assigned specific goals (as opposed to self-conjured goals), energy savings increased further. In terms of the Manly Council and the MEC, most campaigns focus primarily on feedback / information, without any specific goals to accompany the information individuals have received. McCalley suggests when feedback is already being used, such as in the case of MEC, goal setting can be an effective tool in increasing pro-environmental responses. The development of an a mobile application (as previously mentioned) that incorporates mechanisms of feedback and goal setting could be an interesting educational tool for students. Development of an application with goals such as FF spotting (or otherwise) could complement the existing information provided by the MEC and engage younger audiences with the issue.

7.3.2 Visual Representation

Globally, how citizens perceive their role and responsibilities in determining environmental outcomes significantly impacts their attitude towards environmental causes and ultimately the communities potential to adapt and mitigate ecological threats such as climate change. In the case of the GHFF, the ecological consequence of a world without bats is not yet fathomable to the community (Ballard, 2005) - it is a remote problem lacking meaning and tangibility. A study conducted by Nicholson-Cole (2005), looked at the efficacy of computer imagery in changing human behaviour towards 'intangible risks' such as climate change. Nicholson argues that meaningful visualisations depicting theoretical environmental futures could help bridge the gap between abstract concepts and everyday experiences. This technique enables individuals and groups to recognise the importance and impact of their everyday actions. With this in mind, using computer imagery to showcase a future without species such as GHFF could be an effective means of materialising the problem and change the way communities respond to and think about GHFFs. Additionally, the use of "Bat Cams", which record the GHFF camps would bring reality and meaning to this all too detached and distant perspective of GHFF. "EagleCAM" used in Sydney Olympic Park (BirdLife, 2016), has been successful in generating awareness about the fragility, protection needs, and mating times of these seemingly foreign creatures. Much like FF, eagles are intelligent, rare and have come into contact with humans as a result of urbanisation. "EagleCAM", and its associated facebook feed, have been effective tools to inform the community about the importance of these species (Sea-EagleCAM, 2016). The captured and displayed charismatic nature has generated a large community following, and such a technique could be harnessed for the GHFF of Balgowlah (Sea-EagleCAM, 2016). With the aid of technology, computer visuals have the potential to reach and engage a wide range of audiences, and could mark an important method in changing behaviours and attitudes towards the environment.

7.4 Non-price Incentives

7.4.1 Social Contrasting

Resource use tends to increase in high income households where price based incentives are least effective. By incorporating strategies that focus on behavioural and psychological interventions e.g. social comparisons, cognitive dissonance and social norms, changing behaviours of affluent demographics, such as Manly, becomes possible. Ferraro and Price (2010) looked at the efficacy of non-price based intervention strategies, such as social comparisons, in changing water use. Three strategies were used:

1. One-time letters detailing information of ways to reduce water consumption
2. Strategy 1 plus an appeal to pro-social preferences e.g. “every drop counts”
3. Strategies 1 and 2, plus monthly information comparing the individual's water consumption to that of the neighbourhood average e.g. “last month you used more water than 67% of your neighbours”

Strategy three saw the greatest reduction in water use over the study period, highlighting the efficacy of social comparisons in effecting behavioural change.

Intervention strategies for the Manly community and GHFF could benefit from non-price based approaches (such as those detailed below), in conjunction with compensation measures as explored in the Eurobodalla Shire case study (including sound proof windows, and covers for household items).

A proposed management strategy for the MEC is the Distribution of information on the opinions and attitudes of residents and extended neighbourhoods (such as Isaac Council) where FF and humans successfully coexist. Some of the comments from Ballard (2005) and Larsen *et al*., (2002) done on FF attitudes and opinions include:

> *"I have patted a flying-fox and they are adorable and I think a necessary part of our community. Thankyou."* (Ballard, 2005; p.128).

> *“We had some trepidation when we moved in, but we now love them as part of the unique bushland.”* (Larsen *et al*., 2002; p.5).

> *"My children were very interested to go and see them fly over the bridge at night (Rosedale Road) and they are keen to learn more."* (Larsen *et al*., 2002; p.7).
>
> *"They [flying-foxes] are part of the important, rich environmental diversity that is vitally important to maintain ecological balance. This diversity and balance is already being destroyed."* (Larsen *et al*., 2002; p.7).

Furthermore, Alpizar (2008) explores the notion of equity preference and monetary contributions in a conservation study at Costa Rica national park. Individuals were randomly asked to donate to the park by one of three ways:

1. Donate anonymously
2. Receive a gift upon donating
3. Given social reference to point out how much others donate i.e. "others tend to donate $10", and then asked if they too would like to donate.

The most rational human response (according to the economic theory of *expected-utility maximisation*) would be to decline any donation to the park, and to instead 'free ride" off of the public good. Contrary to economic theory however, Alpizar found that donations were common, if framed in the right way.

The experiment found that anonymous donations (1.) and the reception of a gift upon donating (2.) were the least effective means of encouraging tourists to donate - demonstrating how gift based instruments are not always effective in uptake of prosocial and pro-environmental behaviour. Using gifts or incentives for residents impacted by GHFF may therefore be ineffective in long-term attitudinal change towards the camp.

Interestingly, approach number three resulted in the most generous donations from tourists. This method not only activated social norms ("others tend to donate $10"), but also enabled recognition for the act of donating (i.e. not anonymous). Humans need for social recognition is major driver of seemingly 'altruistic' acts such as environmental protection (ecocentric) or pro-social (anthropocentric) endeavours. Throughout human evolution, the ability to assert kindness and acts of selflessness, is associated with power, status and wealth (Barclay & Willer, 2007) (as explored below).

7.4.2 Social Responsibility

Baca-Motes et al (2003) looked at how commitment devices could be used to increase the adoption of pro-environmental behaviours. Hotel guests were asked to make a general or specific commitment towards the environment, such as reusing towels, or adopting sustainable behaviours while at a hotel, and received a “Friend of the Earth” badge in exchange for their commitment. Baca-Motes found that the physical presence of the pin and the written commitment created a spillover effect of sustainable actions and attitudes, whereby guests would take part in other sustainable actions such as turning off the lights. By asking guests, not telling them, to commit to pro-environmental behaviours, a sense of choice, responsibility and social authority is stirred, and pro-environmental actions result. In application the GHFF case study, environmental campaigns could use this commitment method to not only engage the community in the importance of GHFF, but also create a sense of social responsibility. Encouraging the public to sign a petition in support of the protection of GHFF, with the reception of a “bat-protection squad” car sticker (Morris 1987) , might be a successful means of generating community interest and action towards the preservation of these vital species (Figure 9.).

Figure 9. Bat Protection Squad car sticker used to change British attitudes towards bats (Morris 1987). Artist Guy Troughton depicted the bat in an anthropogenically appealing way by giving it “large soulful eyes and a slightly tremulous smile” (Voigt & Kington 2016)

7.4.3 Status

The journal article “Going Green To Be Seen” by Griskevicius et al, (2010) looks at the influence of status and reputation in generating conservation behaviour. The article explores how altruism is perceived as a ‘costly’ symbol, and is thereby associated with status. As such, an individuals desire to receive ‘status’ can motivate and influence participation in pro-environmental behaviour. Pro-environmental, or conservation, behaviour is also recognised as prosocial - a sacrifice of oneself for the good of the public. This prosocial behaviour can build a prosocial reputation, whereby individuals are seen as more trustworthy (Barclay, 2004), and more desirable as friends, allies and romantic partners (Cottrell, Neuberg, & Li, 2007; Griskevicius et al., 2007; Iredale, Van Vugt, & Dunbar, 2008; Miller, 2007; Stiff & Van Vugt, 2008). Therefore, the status enhancing benefits of seemingly altruistic actions, could play a large role in influencing uptake of pro-environmental behaviour. Competitive altruism is historical concept whereby individuals would compete for status by acting more altruistic - the person who is able to give away the most resources is regarded the highest standing member of the group (Barclay & Willer, 2007; Hawkes, 1993; Roberts, 1998; Van Vugt et al., 2007). Could social motives then, such as concern for status, foster conservation behaviour amongst Manly residents? Would playing on these concepts of moral duty, self sacrifice, and altruism aid in changing the perceptions and subsequent actions of the Manly community towards the GHFFs? As noted above, this status activation only works in public spheres where people are able to witness the ‘altruistic’ acts. Status competition in Manly could be an effective means to promote pro-environmental behaviour, and acceptance of GHFF.

The value origins of Manly community are very much egocentric - self preservation, status and elitism influence the behavioral tendencies of the community. Intervention strategies therefore, need to align these values with GHFF protection. Enabling the community to act as ‘champions’ for GHFF (as demonstrated in with Issac Council), could be an effective means of activating values of status via altruism. The members are seen as giving to a cause greater than themselves, and recognised for doing so within the community.

7.5 Shifting Attitudes

7.5.1 Social Norms

Goldstein (2008), explored the power of social norms in environmental conservation programs. Goldstein found that when social norm messages were used in a hotel, such as “we reuse towels”, pro-environmental behaviour increased by 9%. This response was enhanced further when guests

could relate specifically to the demonstrated social norm behaviour i.e. female, family, middle class etc. This is a significant finding is regards the Manly GHFF study - by reducing the “psychological distance” between Manly residents who dislike GHFF and Manly residents (of similar socioeconomic profiles, situations, experiences) who do like GHFF, attitudes towards the GHFF may shift. Figure 10. is an example of how a positive depiction of individuals interacting with bats could activate social norms and favourable attitudes towards FF.

Figure 10. Portrait of Eidolon helvum (left) and Tigga Kingston smiling with the same bat (right) (Voigt & Kingston 2016)

As seen in the protection efforts of Cabbage Tree Bay, activating social norms is a highly effective tool in changing an individual's behaviour. In line with this is the psychological phenomenon of cognitive dissonance. Cognitive dissonance is the discomfort experienced by an individual when their beliefs, values or ideas are contradicted by their actions, external information or other self-held beliefs and values. Dickerson (1992) explores the impact of cognitive dissonance in relation to water conservation. Dickerson highlights the gaps in people's intentions (e.g. wanting to help the environment), and their actions (e.g. long showers) to increase conservation behaviours (e.g. water conservation efforts). Three methods were tested to change water conservation behaviours:

1. “Mindfulness” - participants were shown how much water they use
2. “Public Commitment” - participants were asked to make a commitment to conserve water
3. Combination of methods 1 and 2 - participants were asked to commit to conserving water after having been shown how much water they use

Of these three methods, number three was designed to activate cognitive dissonance by juxtaposing each participant's “commitment to the environment” and subsequent actions. Method

three demonstrated the only significant reduction in water use with shower times shortened by 30%. This study reiterates the power of physiological-based intervention strategies in increasing pro-environmental behaviours. For environmental policy makers, these types of studies provide unique solutions to moral dilemmas of partitioning or restricting resources. For the Manly GHFF case study, intervention strategies that are able to activate dissonance between belief and actions could prove effective in creating pro-environmental behavioural change towards the GHFF camp. For example, the community relies on the preservation of Manly's pristine environment for pleasure, aesthetics, welfare and status. If this is a statement they hold to be true, then preservation of GHFF, due to the fundamental ecosystem services they provide, is necessary. Actions counter to this would activate cognitive dissonance, and in theory, subsequent attitudinal change towards the GHFF camp.

7.6 Information Sharing

7.6.1 Online Platform

Bartle (2011), explores concepts of information sharing, and how the way in which we frame information can influence the degree to which members accept and have confidence in that information. Bartle found that online interactive platforms, delivering information about cycling, were the most effective means of framing information so as to elicit attitudinal change. Experienced and inexperienced cyclists (those with reservations/aberrations towards cycling) were invited to join web platform where information and questions could be shared openly and honestly between the two cyclist groups. This method not only built social ties, but also increased the perceived reliability, knowledge and trust in information being delivered. Positive attitudes towards cycling increased, and the emotions, subjective opinions and social support associated with this type of information sharing enabled a positive behavioural response. This study is important to consider when designing intervention strategies for the Manly GHFF camp. Providing an online, interactive platform between GHFF knowledge enthusiasts and those less-informed, may be a more effective means of changing attitudes than "official" information mechanisms (such pamphlets, websites etc.), commonly employed by MEC.

8. Discussion

8.1 Face-to-face Conversations

Having face-to-face conversations with community members has also proven to be an effective method for generating behavioural change. The MEC found that in starting a shared conversation with members of the community, a space for reciprocity, empathy, and understanding is created. It is in this ‘safe zone’ people's values and beliefs are open to change, and cognitive biases let down. The issue however with this one-on-one method is that it takes time, money and effort - it is not a cost-effective approach for large-scale operations. In instances where small populations need to be targeted however, this method may prove useful, whereby intimate, reciprocal conversations with stakeholder representatives may give rise to collective change.

9. Recommendations

9.1 Council

Larsen *et al.,* (2002) found that the community appreciates the opportunity to be consulted. It is recommended that the council actively demonstrates to the residents of Balgowlah that they are prepared to listen to their issues, as seen in the Eurobodalla Shire Council case study. Therefore, engagement should include intimate reciprocal conversation with the community and stakeholders. Face to face engagement has proven to be effective (Isaac Regional Council, 2014) and one on one consultation could also offer an opportunity for the council to again a deeper understanding of residents' concerns and opinions.

As shown by Isaac Regional Council, by including the press as stakeholders, it is possible to harness media energy to convey accurate messages. Offering regular updates, releases and access to information to the local Balgowlah press will encourage this collaboration. Isaac council also recognised the effectiveness of ensuring that key messages were communicated consistently, providing scripts to those who would be handling public FF complaints. This consistency should be maintained during community engagement at Balgowlah.

The Cabbage Tree Bay (Manly) case study demonstrated the power of association in regards to gaining trust. The public only came on side with the notion of protecting the area above their own needs once the founder of the Australian Marine Conservation Society became involved. Isaac Regional Council also used this technique, appointing the local community officer with established connections to residents as the official FF officer. It is advised that council at Balgowlah appoint a FF officer or advisory board (as in the Cairns case study) with existing connections to the community. An advisory board would also offer residents an opportunity to partake in discussions.

A decline in property value is a key area for concern at Balgowlah. Therefore, it is important for residents to understand that the longevity of a roost is never guaranteed (Parry-Jones & Augee, 1992) (Webb & Tidemann, 1996). However, even if the FF were considered a permanent feature of the area, this does not have to be perceived as a negative. At Gordon, 71% of residents enjoy the presence of FF whilst 74% would choose to live near a colony again (Larsen *et al.*, 2002).

Therefore the Balgowlah camp could attract new residents to the area and informing potential buyers of the FF ensures the new home owners would be accepting of the FF.

As exemplified by Eurobodalla Shire Council, the provision of practical solutions can reduce the impacts of FF on local residents. For community members living within close proximity of the Balgowlah camp the availability of pressure washers, car and washing lines covers could provide relief to the issue of faecal matter. Further community consultation is required to establish if investments in double glazed windows, air conditioning, site landscaping and management would be feasible investments.

As FF are migratory and cover large distances during flyouts (Rose & Tsumura, 2010), so it is important to recognise that management in one areas will have an effect on GHFF in other areas. Therefore management plans at Balgowlah need to go beyond local jurisdictions.

9.2 Balgowlah Community & Site

Sense of place is key to ensuring that residents associate positive feelings towards an area (Gosling & Williams 2010). Manly residents were prepared to stand against removal of the Norfolk Pine trees when it threatened this attachment. Therefore it is suggested that the Balgowlah camp is modelled to become a place with which the local community can a have positive affiliation, feeling of status and emotional connection, with the GHFF championed as an indicator of a healthy environment. In addition to this there is the option to showcase the site to tourists and education providers as a place of ecological significance which would also lend a sense of pride to the local community.

The use of imagery is important when emphasizing consistent key messages visual representation can be used at Balgowlah to ensure that the FF are represented tangibly. A mural painted or designed by local community groups could promote engagement and enhance the ambiance of the site. A potential location for a mural at Burnt Bridge Creek, Balgowlah can be seen in Figure 11.

Figure 11. Potential site for community engagement activity (mural). Balgowlah access path near GHFF camp (Hollingshead, 2016)

People are more likely to care about an animals they can relate to it (Soniak 2014). For many, the FF are currently viewed as an irritating large scale problem rather than as intelligent and interesting individuals. Most people would not have experienced a GHFF up close. As found by the Sea-EagleCAM project (2016) the installation of a 'bat cam' for public online viewing could help connect residents to the GHFF and the site creating an emotional bond.

Celebrity endorsement has proven to be successful with the Manly demographic as demonstrated by Kelly Slater's participation in the Manly-Freshwater World Surfing Reserve project. With research by McDonagh & Prothero (2014) also acknowledging that celebrity endorsements can bring attention, credibility and emotional connections to marketing campaigns. Jenni Cross (2013) also found that marketing materials which pictured a celebrity taking part in environmental protection efforts proved to be more effective than a simple picture of the topics focus. With this is mind, backing from a local celebrity, pictured with FF could connect residents with the large scale environmental issue.

Barclay & Willer (2007) found that people were more likely to 'do the right thing' when offered recognition. Therefore the Balgowlah community may be more interested in donating time/ money/ support to the project if they are given recognition for their efforts. Providing a reward which showcases their contributions such as the "bat-protection squad" car sticker (Morris 1987) or the

“FF living under one sky” (Cairns regional Council, 2014) would give the residents this recognition whilst promoting the cause.

9.3 Education

9.3.1 Educational Messages

Education has proven to play an important part in creating social norms and for setting societal expectations (Ford, 2002). These social norms can impact environmental beliefs, therefore by implementing FF education into the Manly/ Balgowlah community there is a potential to shape these attitudes.

Studies found that found that the public were uninformed on the ecological importance of FF, the associated diseases and potential for transmission (Ballard, 2005) (Larsen *et al.*, 2002). Many also did not know that the FF were or threatened species or the reasons why. Therefore there is a clear need to fill this knowledge gap in order to gain public backing for the protection on the spices.

9.3.2 Wide Scale Education

Large scale community events such as the Cairns Bat festival and the FF summit have contributed towards changing social norms and expectations. Flying out ‘bat chats’ have also proven popular (Cairns Regional Council, 2016) (Larsen *et al*., 2002). It is suggested that in additional community FF events in Manly could help ensure wide scale attitude changes. These events would also offer an opportunity to screen the award winning documentary “Hanging in the Balance” which was created in conjunction with Sydney Bats.

9.3.3 School Education

The presence of elite schools in Manly offers an opportunity to educate the younger generation about FF with the intention that this will also filter into the community. Successful strategies from MECs collaborative Kids, Companies and Creeks program can be used to guide this educational program. Alternatively, FF initiatives could become an additional component to Kids, Companies and Creeks, saving time, money, and resources during the startup phase. The Sydney Bats website provides educational videos such as the “Bat Rap” and bat based activities which could also be incorporated into classroom learning. If the Balgowlah camp is championed as a place of ecological significance then field trips to the site could be incorporated into the syllabus.

9.3.4 Collaborations

In recent years there has been increasing interest in native forests and natural parks, with the appearance of campaigns supporting forests and other important green spaces. It is important to collaborate with external organisations, as some of these initiatives fail to point out the ecological contribution of FF in the maintenance of healthy forests. It is important to highlight that one cannot survive without the other.

9.3.5 Online and Interactive

Interactive programs have proven to be the most effective in creating change (Ennett *et al.,* 1994) (Bartle, 2011). An online FF forum would provide an interactive platform to share knowledge and answer questions. It would offer residents an alternative to contacting council directly, provide an opportunity to educate and change attitudes and while reducing hostility.

A FF mobile phone app would also help with this engagement. If the public had an option to enter data and pictures into the app, it would connect them with the area. It could also offer the potential for a citizen science project which reinforces the idea of Balgowlah becoming an area of ecological importance and pride.

Social media can be used to gauge community attitudes and opinions. While many community members may only attend council meetings to voice a complaint, social media provides a platform for positive feedback to be conveyed. It also encourages the sharing of information and educational materials. In addition to this dedicated Balgowlah flying fox Facebook page could help promote key messages.

Recommendations

Commented [4]: Are we doing anything with this section - essentially a condensed version of what Juls has written, but I quite like it.

Based on research findings, the following recommendations have been devised for MEC and Manly Council (now the amalgamated Northern Beaches Council) for GHFF management in Balgowlah:

1. Early engagement with community is crucial in minimising conflict. Findings from Larsen *et al.,* (2002), and case studies from Eurobodalla Shire Council and MEC, reveal the importance of giving communities the opportunity to be consulted. Therefore, management plans should incorporate reciprocal conversations with stakeholders to encourage transparency, honesty, cooperation and trust.
2. The use of social media and online forums are effective tools for engaging communities, gauging attitudes and opinions of stakeholders, and allowing for feedback. An online platform should be made available to Balgowlah residents and the broader community to raise awareness of FF, and bring to light their importance. Involving experts in the forum to debunk myths, share experiences, and create positive 'social norms', would be a cost-effective means of changing attitudes towards FF.
3. Similarly, Bat Cams, Bat Raps, FF Murals, community events and external organisations need to be utilised to showcase FF, and make their existence tangible.
    a. Bat Cam - Visual recordings such as Bat Cam, would enable the public to perceive the sentience of FFs, and capture their charisma, intelligence, and humanness which is otherwise missing from lectures and literature.
    b. A mural alongside the Burnt Bridge Creek access path would serve as an effective means of engaging the community with the protection of FF. Encouraging local schools, Balgowlah residents and others in the design and creation of the mural instils a sense of individual responsibility and commitment to FF (Figure 11.)

    c. It is necessary to team up with external organisations, councils, and associated sustainability events to highlight the ecological contribution of FF. By doing so, continued links between FF and thriving forests (i.e. one cannot survive without the other), are being created. Likewise management of GHFF in one area impacts GHFF in other areas. Therefore management plans need to go beyond local jurisdictions. These efforts will ensure the issue of FF protection is communicated, managed and shared accordingly, while instilling a sense of connectivity between FF and other sustainability issues.

4. Setting expectations and creating social norms
    a. Education programs targeting schools and the broader community would play a key role in setting expectations and creating social norms around FF coexistence - excursions, experiential learning, and links to programs such as Kids, Companies, Creeks
    b. Referencing how other communities coexist with FF, to facilitate the development of social normative behaviour in favour of FF
    c. Celebrity endorsement of FF - using a local icon to champion the preservation of FF
5. Champion for FF – allowing Balgowlah residents to take ownership of the issue and advocate for GHFF preservation. This psychological tool targets status / social altruistism, cognitive dissonance, and social responsibility phenomena.
    a. Commitment devices - Setting up a GHFF management committee whereby residents can can be on the board
    b. Displays of social responsibility and “altruism” - “Bat Protection Squad” “Living Under One Sky” car or window stickers
6. Drawing on the value orientations of Balgowlah residents - egocentrism and materialism, efforts to tidy up the site and increase the sense of place and pride could have multiple benefits. Creating an engaging space for tourists, with the GHFF camp serving as the ‘iconic’ feature, would not only instill a sense of purpose of place, but create energy and excitement around GHFF protection. However, efforts to transform the site into an aesthetically pleasing one requires extensive costs of planning, revegetation, and labour (Table 4).
7. Practical household solutions, although costly, would minimise the associated disadvantages of living near FFs. Double glazed windows and covers for outdoor equipment should be considered in future management plans. Likewise, informing potential property

buyers about the presence of FFs, and the management processes in place, is necessary to instil a sense of trust, reciprocal communication, and immediately debunk any myths or negative connotations buyers may have towards FF. This also plays a role in setting expectations and social norms of FF acceptance in the community.

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