Using New South Wales planning instruments to improve conservation and management of Grey-headed Flying-fox camps

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ABSTRACT

The listing of Grey-headed Flying-foxes Pteropus poliocephalus as Vulnerable on the NSW Threatened Species Conservation Act (TSC Act) initiated a shift in management focus from control to conservation. The process has highlighted the need to preserve roosting habitat for the species and develop strategies to limit conflict with neighbours. This paper documents the conservation status of Grey-headed Flying-fox camps located east of the escarpment in NSW and explores the potential to use existing planning instruments to 1) protect roost vegetation from clearing and 2) limit conflict with humans by restricting development around camp perimeters (buffers). In coastal NSW, only 27% of camps and 16% of buffers are in conservation reserves. A high percentage of sites are on privately owned land where land use is regulated through the zoning and land use controls prescribed by local government. Protection of vegetation within a camp should greatly improve under the requirements of the TSC Act. However, there are no provisions in the Act to restrict development around camps. The effective use of buffers to limit conflict with humans could be achieved using the Environmental Planning Instruments under the NSW Environmental Protection and Assessment Act 1979 (EP&A Act). For example, the perimeters of camps could be zoned for environmental protection in Local Environment Plans with land use controls that restrict development. This planning-based strategy requires a substantial investment in time and effort to implement. However, it has the potential to secure conservation and management outcomes that will benefit Grey-headed Flying-foxes and local communities into the future.

Introduction

Conflict between humans and roosting Grey-headed Flying-foxes *Pteropus poliocephalus* is an ongoing and apparently increasing problem in coastal areas of New South Wales (Smith 2002; Tidemann 2002; West 2002). This is due in part to rapid growth in the human population in this area of the state, and corresponding changes in land use. Since the 1980s populations in coastal areas north from Sydney have grown at rates of approximately 1% per year (NSW Department of Planning 1995). This trend is projected to continue over the next 25 years. As a result, camps that were once isolated from human activities are increasingly surrounded by urban and rural residential development (Smith 2002; West 2002) or destroyed (Hall 2002). The recent listings of Grey-headed Flying-foxes as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have highlighted the need to preserve camp vegetation and take steps to reduce conflict with humans.

Grey-headed Flying-foxes roost in large aggregations in the exposed branches of canopy trees (Ratcliffe 1931; Nelson 1965; Parry-Jones and Augee 1992). The locations of camps are generally stable through time, and several sites have documented histories that exceed 100 years (Lunney and Moon 1997). Patterns of camp

Pages 240 - 250 in *Managing the Grey-headed Flying-fox as a Threatened Species in New South Wales*, edited by Peggy Eby and Daniel Lunney, 2002. Royal Zoological Society of New South Wales, Mosman NSW.

occupation vary, ranging from camps that are inhabited continuously to those that are inhabited only rarely (Eby 1995). Camp size fluctuates over short periods of time and annual peaks can exceed 50,000 flying-foxes (Ratcliffe 1931; Eby 1991; Eby *et al.* 1999; Parry-Jones and Augee 1992).

The concentration of large numbers of Grey-headed Flying-foxes into relatively small areas creates a number of management problems. In NSW, where rates of forest clearing are high, roost vegetation may be at risk (Eby 1995). In addition, the large aggregations of animals are vulnerable to persecution (Ratcliffe 1931; Tidemann 1999). This is of particular concern during the maternity season, October to March, when disturbance may disrupt associations between lactating females and dependent young (Martin and McIlwee 2002). Roosting animals can also damage the vegetation, and this is of particular concern when camps occur in remnants of high conservation value (Eby and Palmer 1991; Tidemann 1999; Pallin 2000). Finally, people living near camps are exposed to several inconveniences, including noise from the vocal communications of animals during the day and pre-dawn when they return from foraging; the pungent smell created by the dense concentration of animals; and concerns about disease (Eby 1995; Tidemann 1999; Smith 2002).

Traditionally, the management of flying-fox camps has focused on controlling numbers and breaking site fidelity (Ratcliffe 1931; Lunney and Moon 1997, Vardon *et al.* 1997; Tidemann 1999). Attempts have been made to reduce conflict by moving animals from contentious sites or by reducing the size of camp populations. In the past, mass killing using firearms or explosives was the preferred method for reducing camp size (Ratcliffe 1931; Lunney and Moon 1997). This practice was founded on an assumption that camps comprised closed populations and that rapid increases in numbers were the result of population "explosions" that could be reversed through culling. However, studies of migration and roosting behaviour have consistently shown that large fluctuations in camp size are the result of immigration and emigration (Nelson 1965; Eby 1991; Spencer *et al.* 1991). In addition, the reproductive biology of flying-foxes precludes rapid increases in population (Martin and McIlwee 2002). Despite their long-term ineffectiveness, mass culls occurred for over 100 years (Lunney and Moon 1997).

Flying-foxes in NSW were first afforded protection from culling in camps in 1986 when they were listed as protected under the NSW *National Parks and Wildlife Act 1974* (Eby 1995). Since then, non-destructive deterrence methods have achieved limited success in altering the use of camps (Vardon *et al.* 1997; Hall 2002; Smith 2002; Tidemann 2002; D. Bidwell pers. comm., 2001, Royal Botanic Gardens Sydney). No controlled trials have been conducted, and anecdotal reports of effectiveness are often inconclusive. The only method that has consistently proven effective in permanently removing roosting flying-foxes is clearing camp vegetation (Lunney and Moon 1997). However, this technique has unpredictable outcomes. The criteria flying-foxes use to select camps are unknown, consequently subsequent locations cannot be predetermined. There are several examples of replacement camps being established in controversial locations, negating the benefits of removal from the initial site (Lunney and Moon 1997; Hall 2002).

There is a growing view that management strategies for flying-fox camps should promote the use of pre-emptive measures to protect camp vegetation and ameliorate conflict (see discussions in Plenary 2). For example, it has been proposed that future disputes could be avoided by limiting development such as residential housing, schools and commercial or industrial estates around the perimeter of camps.

Experiences at various camps support the view that conflict between local communities and flying-foxes increases as development, particularly residential development, encroaches on camp vegetation (Hall 2002; Smith 2002; West 2002). For example, over the past fifteen years, the rapid expansion of the city of Coffs Harbour, NSW has brought residential housing progressively closer to the Coffs Creek camp. In the most recent phase of development, houses were constructed at the edge of camp vegetation. The development has been accompanied by a marked increase in complaints about the camp and requests that the bats be relocated further from houses (Smith 2002).

By contrast, few complaints are generated by the flying-fox camp at Cabramatta, a densely populated suburb of Sydney (K. Sommerville pers. comm., 2002, S.P.A. Consulting P/L; J. Spence pers. comm., 2002, Cabramatta Creek Flying-fox Committee). The camp is situated on flood-prone land and is surrounded by public open space. The nearest

house is approximately 300 meters from the area inhabited by flying-foxes. The absence of conflict at this site has been attributed to the distance between the camp and residential development.

It has been proposed that appropriate planning instruments for limiting development on the perimeter of flying-fox camps could be found in existing statutes (Conway 2002). The spatial stability of flying-fox camps makes them suitable for the map-based Environmental Planning Instruments established in the NSW *Environmental Protection and Assessment Act 1979* (EP&A Act) (reviewed in Conway 2002). There are several advantages to this approach. It exploits existing behaviours of flying-foxes (roost fidelity) rather than relying on altered patterns of behaviour; it promotes a custodial and conservation approach to management that is appropriate to a species in decline; and it initiates a long-term solution that will offer greater certainty.

In this paper I document the conservation status of Grey-headed Flying-fox camps located east of the escarpment in NSW and explore the potential to use existing planning instruments to improve the conservation of roost vegetation and limit conflict between flying-foxes and humans. This work is part of a project initiated by the Threatened Species Unit of NSW National Parks and Wildlife Service (NSW NPWS).

Methods

Mapping camps and buffers

Surveys of Grey-headed Flying-foxes conducted over several years have produced a data set of 125 camps located east of the escarpment in NSW. Each camp has been inhabited during the past 10 years. Their locations were plotted on topographic maps, using ArcView GIS software. Initially, polygons outlining the camp boundaries were digitised at 1:25,000. Images of the maps were enlarged where necessary to increase accuracy. Camp boundaries vary with population size or with small-scale shifts in the location of roosting flying-foxes. Boundaries were defined by the full extent of the area that flying-foxes were known to use. The data for each camp took into consideration the experience of the author as well as the observations of various others (e.g. flying-fox researchers, local residents, field staff of NSW NPWS and State Forests of NSW (NSW SF), and field naturalists). Where the camp boundary could not be clearly identified on the topographic maps, it was interpreted from recent aerial photos and transcribed onto the map layer.

A nominal buffer around each camp in which development could usefully be limited was also mapped. It was not within the scope of this work to define unique buffers for each camp. The dimension and configuration of zones of restricted development vary from camp to camp in relation to such variables as topography, prevailing winds, the exit paths used by departing flying-foxes and existing land use. For consistency, buffers were arbitrarily defined as a band 400 m wide around the perimeter of each camp.

Finally, various physical features of camps and their surrounds were recorded from the digitised maps. The altitude at the centre of camp polygons was recorded, as was distance from the nearest waterway (river, creek or major drainage line). The area of continuous vegetation associated with camps was estimated in ArcView by drawing coarse polygons from maps and aerial photographs. The data were grouped as <20 ha, 20-<100 ha, 100-<500 ha, ≥ 500 ha.

Conservation status of camps

The conservation status of each camp and buffer was interpreted from tenure and zoning information for the site. Tenure was documented from pre-existing GIS layers held by NSW NPWS. This identified land under the jurisdiction of NSW NPWS and NSW SF, Vacant Crown Land and freehold land subject to Voluntary Conservation Agreements (VCAs) between NSW NPWS and the landholder.

Where land was administered by state land management agencies, its conservation status was interpreted from the policies of that agency. For example, the policy for managing flying-fox camps in State Forests is set out in Section 5.14.4. of the 'Terms of License under the *NSW Threatened Species Conservation Act*'. According to this policy, forestry activities must be excluded from the full extent of known flying-fox camps. An exclusion zone of 50 m must be implemented around the camp of the threatened Black Flying-fox, and consideration must be given to implementing an exclusion zone of 200 m around the camp. NPWS proposes to extend these terms to include Grey-headed Flying-foxes.

Where land use was regulated by Local Government Authorities (LGAs), conservation status was interpreted from material published in the Local Environment Plans developed and published by each LGA. LEPs generally use a system of zoning, which is a broad method of land use control in which particular forms of development may be either permissible without

consent, with consent, or prohibited altogether. The zones are indicated on a zoning map, and the relevant controls for a zone are contained in the land use tables of the LEP. In general, LEPs use a common set of zone classifications, although variations between LGAs occur in the definitions of sub-categories and in the controls defined in land use tables.

Local governments can vary the zone applied to land by either issuing a new LEP over that land, or by amending the pre-existing LEP. Planning NSW (formally NSW Department of Planning) maintains an up-to-date account of all LEPs and their amendments. Zone information for this study was taken from their records of February and March 2001. Tenures and zones of camps and buffers were recorded separately and grouped into the following land use categories:

1. Conservation reserves – includes zone 8 (land managed by NSW NPWS: National Parks, Nature Reserves, State Recreation Areas) and land subject to Voluntary Conservation Agreements (VCAs);
2. Environment protection zones – zone 7 (freehold, vacant Crown Land or land administered by LGAs, and zoned as wildlife habitat, scenic lands, wetlands, environmentally sensitive land, etc.);
3. State Forest – zone 1f (land managed by State Forests of NSW);
4. Public reserves – zone 6 (open space zoned as a public park, garden, recreation reserve, etc.);
5. Agricultural – freehold land zoned to promote and preserve agricultural practices, commonly zone 1a (rural zoned for agriculture), and 1b (zoned to retain rural atmosphere);
6. Residential – freehold land zoned 2a (urban residential), 1c (rural residential, small holdings) and 1v (village);
7. Commercial – freehold land zoned 3 (business) and 4 (industry), and in Central Sydney, city centre, city edge, maritime and transport.

Camps and buffers occasionally included land in more than one of the categories listed above. When a single category was estimated to cover >90% of the area, it was considered to be the category for the entire polygon. When a category was estimated to cover <10% of the area, it was omitted from consideration. In the remaining cases, the land use category conferring the lower level of protection from clearing or development was used in the data summaries (see below).

Camps were then grouped two ways: 1) sites where the terms of tenure and zoning explicitly protect the vegetation from being cleared, and 2) sites where vegetation was afforded no such protection. The following land use categories explicitly protected land from clearing: National Parks and reserves, environmental protection zones and State Forests. In addition, vegetation in two camps zoned as public space was protected from clearing and they were included in this group.

Buffers were grouped two ways as: 1) sites where the terms of tenure and zoning restrict development to a level deemed sufficient to limit conflict with humans, and 2) sites where development that is likely to result in conflict is permitted. Development that might lead to conflict included urban and rural residential housing, commercial and industrial development, schools, sports grounds and agricultural land used as commercial orchards. Other agricultural land was not considered prone to conflict, although it is noted that disease issues may arise in piggeries and equine centres (Field 2002). Buffers in the following land use categories were considered prone to incompatible development: commercial, residential, some public reserves, and zoned for use by education institutions.The extent of existing development in buffer areas at the time of the study was determined from either personal observations during the preceding two years, or from examining aerial photographs taken during that period.

Results

A high percentage of the 125 Grey-headed Flying-fox camps was in small patches of remnant vegetation; 35% were in patches smaller than 20 ha, 27% were smaller than 10 ha (Figure 1; Appendix 1). An equivalent percentage was in expanses of forest >500 ha. The altitudes of camps ranged from sea level to 420 m; 56% were below 20 m and 80% were below 100 m; and 94% were located on or immediately adjacent to waterways.

Thirty-nine Local Government Areas in coastal NSW contained flying-fox camps. The median number of camps per Local Government Area was three; 12 contained one camp, and one, Maclean Shire Council, contained nine camps.

The land use categories of the camps and their adjoining buffers are presented in Appendix 1. The zoning of one camp, Angourie, was under review at the time of this study and it was deleted

from the data. Of the remaining 124 camps, 49 (39.5%) were under the jurisdiction of state land management agencies (Figure 2); 34 (27.4%) were on land managed by NSW NPWS and 15 (12.1%) were on land managed by NSW SF. Land use in one camp, Kurnell, was defined in a Regional Environment Plan (REP #17, Kurnell Peninsula). Land use in the balance of sites was defined in LEPs. The majority of camps regulated by LEPs were rural sites zoned for either agriculture or environmental protection (Figure 2). However, 10 camps (8.1%) were zoned for residential or commercial development.

Thirty-two buffers (25.8%) were under the jurisdiction of state land management agencies; 20 (16.1%) were managed by NSW NPWS and 12 (9.7%) were managed by NSW SF. In all but one case the associated camps were also under the jurisdiction of the agency. Thirty-seven (29.8%) buffers were zoned for residential or commercial development. Substantial development had already occurred within a 400 m perimeter of 27 camps (21.8%).

The proportion of buffers in the various zone categories differed significantly from that of camps (Figure 2, $\chi^2 = 41.35$, d.f.=5, $p<0.001$; note: land zoned commercial was grouped with land zoned residential in the χ^2 analysis to ensure

Figure 1. The percentages of 125 Grey-headed Flying-fox camps in four vegetation size classes.

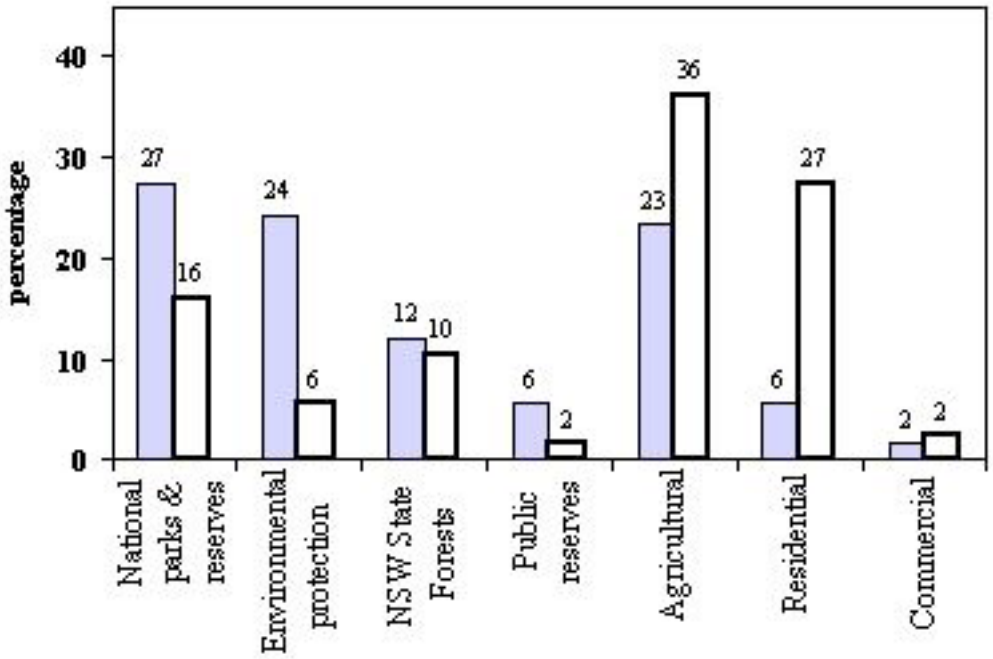

Figure 2. The percentages of 124 Grey-headed Flying-fox camps (grey bars) and 400 m buffers (hatched bars) in each of seven zone categories (see text for definitions). Note the relatively high percentage of camps zoned for environmental protection and agricultural use, and the relatively high percentage of buffers zoned for agricultural use and residential development.

<20% of expected values were <5.0 (Zar 1984)). In particular, significantly fewer buffers than expected were zoned for environmental protection, and significantly more buffers were zoned for residential or commercial development.

In 79 camps (63.7%), vegetation was protected from clearing either through the policies of NSW NPWS and NSW SF or through the conditions of zones imposed by LGAs. In 86 buffers (69.4%), development deemed likely to result in conflict between humans and flying-foxes was not permitted; and 45 (36.3%) were buffers zoned for agriculture.

Discussion

The conservation status of Grey-headed Flying-fox camps in coastal NSW varies between sites that are isolated from humans by expansive tracts of National Park, to small patches of degraded vegetation that are zoned for residential development and surrounded by houses. Landscape characteristics are not indicative of the importance of camps to the species. Several small, highly degraded sites are associated with significant food sources and can contain populations of more than 20,000 flying-foxes (Eby *et al.* 1999; author's pers. observations).

Prior to listing Grey-headed Flying-foxes as threatened in NSW, no consolidated effort was made to protect camps from clearing. Nor was there a co-ordinated initiative to protect flying-foxes and humans from the conflict that results from development on the perimeter of camps (Eby 1995). The consequences of poor planning for Grey-headed Flying-fox camps can be seen in several communities in coastal NSW and Queensland where substantial, ongoing efforts are required to manage disputes between affected neighbours and local councils, NSW NPWS and interested parties (Tidemann 1999 and 2002; Hall 2002; Smith 2002; West 2002).

The majority of Grey-headed Flying-fox camps occur in a landscape of rapidly changing land use and a substantial number are not protected from clearing or development in the perimeter areas. Without explicit attention, pressure from development will reduce the security of camp vegetation and increase the likelihood of conflict.

Protecting camp vegetation from clearing

At the time of this study, 34 camps were afforded the high level of protection and security of tenure associated with conservation reserves. In the majority of sites, the degree of protection from clearing was determined at the local level through the environmental planning policies of local government as reflected in zoning categories and land use controls. Although a high percentage of camps were zoned for environmental protection, this occurred incidentally. In only two sites was the presence of a flying-fox camp a consideration of zoning. In all other instances, the zoning reflected other conservation values of the sites such as rainforest vegetation, wetlands, riparian habitat or scenic values.

Prior to the listing of Grey-headed Flying-foxes under the TSC Act, NPWS could do little to influence management of camp vegetation outside reserves (Smith 2002). However, the potential for protecting roosts has substantially improved. Under the EP&A Act, developments or activities that are likely to have a significant impact on a Vulnerable species require a rigorous process of approval (Conway 2002). A Species Impact Statement (SIS) must be prepared and considered by the approval body, usually local government. In addition, the development or activity must secure the concurrence of the Director-General of NSW NPWS. This process can be effective in limiting the impacts of development-related threatening processes.

The clearing of camp vegetation is acknowledged as a threatening process for Grey-headed Flying-foxes. In its Final Determination to list the species as Vulnerable, the NSW Scientific Committee stated in point 7 that, "The main threat to Grey-headed Flying-foxes in NSW is clearing or modification of native vegetation. This removes appropriate camp habitat and limits the availability of natural food resources…", and again in point 9 "The species is also threatened by … the destruction of camps …".

By explicitly defining clearing and destruction of camps as threats to Grey-headed Flying-foxes, the Final Determination ensured a heightened level of protection. For this protection to come into effect, the agencies or bodies responsible for land use must be made aware of the listing of the species and the locations of camps under their jurisdiction. For example, LGAs are often unaware of the locations of flying-fox camps and are unlikely to instigate an SIS on developments that affect camps that are not known to them. NSW NPWS is working to rectify this situation. The camps in this study have been placed on a register and the process of making their locations known to regional offices of NSW NPWS and NSW SF, and to local governments has commenced.

Protecting buffers from development

Perhaps the greater management challenge for Grey-headed Flying-fox camps is ameliorating conflict with neighbours (Tidemann 1999 and 2002; Hall 2002; Smith 2002; West 2002). This paper recommends the establishment of buffers around existing camps in which development is carefully regulated. The objective is to protect humans from roosting flying-foxes, and thereby protect flying-foxes from harassment.

This study did not aim to define the width of buffer needed to limit conflict around camps. The expectation is that buffer size will vary from site to site. A community survey suggested that a width of 100 m would be adequate at the Ku-ring-gai Flying-fox Reserve (Larsen *et al.* 2002). However, this camp is located in a gully and flying-foxes rarely roost at the same height as the surrounding houses. The experience at the Dallis Park camp near Murwillumbah suggests that buffer width at more level sites may need to be greater than 100 m. People residing over 200 m from this roost were adversely affected by strong odour from the camp and campaigned strongly for the removal of the bats (author's unpublished data).

In general, the conservation status of buffers is poorer than camps. It is not uncommon for camps protected from clearing to be surrounded by privately owned land that is cleared and zoned for residential development. In 27 camps, substantial residential or commercial development already exists within 400 m of the site. These camps will continue to challenge managers, requiring ongoing programs of conflict resolution and community education, and attracting debate over further development (Lunney and Moon 1997; Hall 2002; Larsen *et al.* 2002; Smith 2002). In a further 10 camps, the perimeter is zoned for development that has yet to occur. It is likely that these sites will become points of ongoing conflict.

There is no provision in the TSC Act that can be invoked to restrict development around flying-fox camps. As described by Conway (2002), the TSC Act contains strong provisions to protect threatened species and their habitat from threatening processes. However, they do not include provisions to limit the impact of threatened species on humans or to reduce conflict between humans and threatened species. The Environmental Planning Instruments (EPIs) under the EP&A Act are the best vehicles available for regulating development in buffers. For example, under LEPs, buffers could be zoned for environmental protection with zoning conditions that restrict development. This strategy requires local support. In particular, it requires recognition on the part of the community of the long-term costs of development near flying-fox camps, and the benefits that can be achieved by regulating development in these areas (Hall 2002; Smith 2002).

The greatest scope for improving management outcomes at Grey-headed Flying-fox camps exists at the 45 sites where buffers are currently zoned for agriculture. In these cases, land valuations and the expectations of owners have not been altered by potential development, and resistance to zoning for environmental protection should be relatively low. The current security of these sites should not be construed as reason for ranking them at low priority for attention. The experiences of the past 15 years indicate that pressures on local government to zone agricultural land for residential development will increase with increasing human populations, and the potential for rezoning is high. The most effective efforts may come from here.

This local planning-based management strategy for avoiding conflict at Grey-headed Flying-fox camps requires considerable foresight, and a substantial investment in time and effort. However, it has the potential to secure conservation and management outcomes that will benefit Grey-headed Flying-foxes and local communities into the future.

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APPENDIX I

Appendix 1. Land use categories of 125 Grey-headed Flying-fox camps and 400m perimeter buffers determined by the tenure and zoning at each site. Categories are defined in the text.

Camp name	LGA	Land use category camp	Land use category buffer	Vegetation size class
Aldavilla	Kempsey	residential	residential	20 - <100
Angourie	Maclean	under review	under review	100 - <500
Anna Bay	Pt Stevens	env. protection	residential	100 - <500
Arakoon	Kempsey	residential	residential	100 - <500
Bark Hut Road	Ulmarra	SF	SF	500+
Beashel's Trig	Eurobodalla	SF	SF	500+
Bellingen Island	Bellingen	env. protection	residential	<20
Belmont	Lk Macquarie	env. protection	residential	20 - <100
Bermagui	Bega Valley	NPWS	NPWS	500+
Black Hill	Cessnock	agriculture	agriculture	500+
Blackbutt Res.	Newcastle	env. protection	residential	100 - <500
Boat Harbour	Lismore	NPWS	agriculture	<20
Bolorobo Is.	Maclean	agriculture	agriculture	<20
Bonville Creek	Coffs Harbour	NPWS	NPWS	100 - <500
Boolambayte Ck	Great Lakes	SF	SF	500+
Booyong	Byron	env. protection	agriculture	<20
Botanic Gardens	Sydney	public reserve	commercial	<20
Bowraville	Nambucca	public reserve	residential	<20
Brombin	Hastings	agriculture	agriculture	<20
Brooks Rd	Tweed	agriculture	agriculture	20 - <100
Brownlow Hill	Wollondilly	agriculture	agriculture	<20
Bruxner Park	Coffs Harbour	NPWS	NPWS	500+
Bugong Ck	Shoalhaven	env. protection	env. protection	500+
Bungawalbin	Richmond R	agriculture	agriculture	500+
Cabramatta	Liver/Fairf	env. protection	residential	<20
Candelo	Bega Valley	agriculture	residential	100 - <500
Casino	Casino	env. protection	residential	<20
Cessnock	Cessnock	agriculture	agriculture	500+
Clybucca	Kempsey	agriculture	agriculture	20 - <100
Coffs Creek	Coffs Harbour	residential	residential	<20
Comerong Is	Shoalhaven	NPWS	NPWS	100 - <500
Coocumbac Is	Greater Taree	NPWS	NPWS	<20
Coopers Shoot	Byron	agriculture	residential	<20
Coraki	Lismore	agriculture	agriculture	<20
Coramba	Coffs Harbour	NPWS	agriculture	20 - <100
Cranky Corner	Singleton	agriculture	agriculture	500+
Cresc Hd Rd	Kempsey	public reserve	agriculture	<20
Crescent Head	Kempsey	env. protection	residential	500+
Currie Park	Lismore	env. protection	public reserve	<20
Currockbilly Mtn	Shoalhaven	NPWS	NPWS	500+
Dallis Park	Tweed	residential	residential	<20
Davis Scrub	Lismore	NPWS	agriculture	<20

APPENDIX I

Camp name	LGA	Land use category camp	Land use category buffer	Vegetation size class
Deep Creek	Kempsey	agriculture	agriculture	20 - <100
Doughboy Rd	Nymboida	SF	SF	500+
Dulguigan	Tweed	agriculture	agriculture	20 - <100
Dunbogan	Hastings	env. protection	residential	20 - <100
East Ballina	Ballina	env. protection	residential	20 - <100
England's Rd	Coffs Harbour	agriculture	agriculture	20 - <100
Esk River	Maclean	NPWS	NPWS	100 - <500
Ewingsdale	Byron	env. protection	agriculture	<20
Farlow'sSwamp	Maclean	env. protection	env. protection	500+
Fullerton Cove	Pt Stevens	NPWS	NPWS	500+
Glen William	Dungog	agriculture	agriculture	<20
Glenrock	Lk Macquarie	NPWS	NPWS	100 - <500
Glenugie	Ulmarra	SF	SF	500+
Gordon	Warringah	NPWS	residential	500+
Italia Road	Pt Stevens	SF	SF	500+
Jamberoo	Shell Harbour	agriculture	agriculture	100 - <500
Jilliby	Wyong	agriculture	agriculture	500+
Jocks Crossing	Kempsey	agriculture	agriculture	500+
Kioloa	Shoalhaven	SF	SF	500+
Kiwarrak	Greater Taree	SF	SF	500+
Kurnell	Sutherland	commercial	commercial	<20
Kyogle	Kyogle	residential	residential	<20
Lawrence	Maclean	env. protection	env. protection	20 - <100
Lumley Park	Ballina	env. protection	residential	<20
Maclean	Maclean	env. protection	residential	<20
Maclean Gully	Maclean	env. protection	residential	<20
Maguires Creek	Ballina	residential	residential	<20
Mallanganee	Copmanhurst	NPWS	NPSW	500+
Marshalls Creek	Byron	NPWS	residential	20 - <100
Martinsville	Lk Macquarie	env. protection	env. protection	500+
Matcham	Gosford	NPWS	residential	100 - <500
Meerschaum	Ballina	agriculture	agriculture	100 - <500
Menangle	Wollondilly	agriculture	agriculture	20 - <100
Mollies Grass	Lismore	env. protection	agriculture	<20
Monkerai	Dungog	NPWS	NPWS	500+
Moore Park	Kyogle	NPWS	agriculture	20 - <100
Morriset	Lk Macquarie	env. protection	env. protection	20 - <100
Moruya Heads	Eurobodalla	residential	residential	<20
Mt Richardson	Dungog	env. protection	env. protection	100 - <500
Mt. Kembla	Wollongong	NPWS	NPWS	500+
Mt. Pikapene	Copmanhurst	NPWS	NPWS	500+
Myocum	Byron	env. protection	agriculture	<20
Narooma	Eurobodalla	public reserve	residential	500+
Nelligen Creek	Eurobodalla	SF	SF	500+

APPENDIX I

Camp name	LGA	Land use category camp	Land use category buffer	Vegetation size class
Nymb Power	Nymboida	agriculture	agriculture	500+
Nymboida	Nymboida	NPWS	NPWS	500+
Ocean Shores	Byron	NPWS	residential	20 - <100
Olive Gap	Richmond R	NPWS	NPWS	500+
Oxley Cove	Tweed	env. protection	residential	<20
Pambula	Bega Valley	NPWS	agriculture	500+
Paterson	Dungog	agriculture	agriculture	500+
Penrith	Penrith/Blue Mtns	commercial	commercial	<20
Peter Finn	Kyogle	NPWS	agriculture	100 - <500
Pine Creek	Coffs Harbour	SF	SF	500+
Ramornie	Nymboida	SF	SF	500+
Red Hill	Hastings	agriculture	agriculture	500+
Rock Valley	Lismore	env. protection	agriculture	<20
Sandon	Maclean	NPWS	NPWS	20 - <100
Sandy Flat Ck	Wollondilly	NPWS	NPWS	500+
Schnapper Is	Pt Stevens	NPWS	agriculture	<20
Sea Acres	Hastings	NPWS	residential	20 - <100
Singleton	Singleton	public reserve	residential	<20
Smiths Lake	Great Lakes	public reserve	residential	<20
Stotts Island	Tweed	NPWS	NPWS	100 - <500
Stroud	Great Lakes	agriculture	agriculture	<20
Susan Island	Grafton	NPWS	NPWS	<20
Terania Creek	Lismore	NPWS	agriculture	500+
Toukley	Wyong	env. protection	public reserve	20 - <100
Tuckean	Lismore	env. protection	env. protection	100 - <500
Ulgundahi	Maclean	agriculture	agriculture	<20
Wardell	Ballina	env. protection	agriculture	100 - <500
Wheeney Creek	Hawkesbury	NPWS	NPWS	500+
Whiporie	Richmond R	agriculture	agriculture	20 - <100
Wingham Brush	Greater Taree	env. protection	residential	<20
Woodburn	Richmond R	agriculture	agriculture	20 - <100
Woolgoolga Ck	Coffs Harbour	SF	SF	500+
Wooli River	Ulmarra	NPWS	NPWS	500+
Wooli Town	Ulmarra	public reserve	residential	<20
Wootton	Great Lakes	SF	agriculture	500+
Yarrahapinni	Nambucca	SF	agriculture	500+
Yarramundi	Hawkesbury/ Penrith	env. protection	residential	<20
Yatteyattah	Shoalhaven	NPWS	agriculture	20 - <100