Coxen's fig-parrot *Cyclopsitta diophthalma coxeni* recovery plan 2001–2005

Prepared by the Coxen's Fig-Parrot Recovery Team

Queensland Government
Queensland Parks and Wildlife Service

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Publication reference:
Coxen's Fig-Parrot Recovery Team. 2001. Coxen's fig-parrot *Cyclopsitta diophthalma coxeni* recovery plan 2001–2005. Report to Environment Australia, Canberra. Queensland Parks and Wildlife Service, Brisbane.

Cover illustration: Coxen's fig-parrot

Cover illustrator: Sally Elmer with technical assistance from John Young

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Summary

Current Taxon Status

Coxen's fig-parrot is listed as endangered:

- on Schedule 2 of the Queensland *Nature Conservation (Wildlife) Regulation 1994*, subordinate legislation to the *Nature Conservation Act 1992*;
- on Schedule 1 of the New South Wales *Threatened Species Conservation Act 1995*; and
- under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

It meets the criteria for critically endangered under the International Union for the Conservation of Nature (IUCN SSC 1994) categories of threat, category C2a (population estimated to be <250 mature individuals and in continuing decline, no subpopulation contains more than 50 mature individuals). It is listed as critically endangered by ANZECC (1995) and Garnett and Crowley (2000).

The subspecies appears on Appendix 1 of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES).

Coxen's fig-parrot is one of Australia's rarest and least known birds. It has been recorded on just over 200 occasions since Gould described it in 1867. Confirmed or credible sighting reports continue to be made in both range states, including about 30 records in north-east New South Wales since 1970 and twice this number in south-east Queensland over the last decade alone. Nevertheless, accurate predictions about population size are currently not possible.

Coxen's fig-parrot is cryptic and extremely difficult to see in its habitat and may therefore be more common than the number of sightings suggest.

Habitat Requirements and Limiting Factors

Within its range, Coxen's fig-parrot occurs wherever fig trees are present in lowland and upland forest types, riparian corridors, farmland and urban environments. It feeds primarily on the seeds of figs. The taxon has declined due, at least in part, to the clearing of lowland subtropical rainforest in south-east Queensland and north-east New South Wales. Remaining habitat is fragmented and seasonal food shortages may occur. Other unknown threats may also apply. The plight of Coxen's fig-parrot highlights the importance of conserving areas of undisturbed habitat that are large enough to allow the it refuge from threatening processes, and that provide connectivity between occupied areas.

Recovery Objectives

The overall objective of this recovery plan is to prevent extinction of Coxen's fig-parrot from human-induced causes and ensure the stability of wild populations. Specific objectives during the life of the current recovery plan are to:

- locate one or more remaining populations;
- protect remaining populations and their habitat from human-induced threatening processes, thereby maintaining the populations and habitat;
- increase understanding of the ecology of Coxen's fig-parrot ;
- secure and breed a captive population of Coxen's fig-parrots; and
- increase the extent, quality and connectivity of the habitat of Coxen's fig-parrot.

Recovery Criteria

The success of the recovery program will be assessed against the following criteria:

- at least one remaining population is located;
- ecological assessment and monitoring strategies are established;

- wild populations have not suffered reduction as a result of any factors other than stochastic events;
- knowledge of the bird's conservation status, current distribution, life history and taxonomic status is significantly increased;
- at least one pair of Coxen's fig-parrot founders is established and breeding in captivity;
- existing habitat is mapped and conserved, and at least two priority areas of degraded habitat are rehabilitated; and
- active community participation in Coxen's fig-parrot recovery is achieved.

Actions Needed

The following recovery actions are required:

- implement an ecological assessment and monitoring strategy;
- undertake captive breeding and release;
- assess Coxen's fig-parrot habitat;
- protect and enhance Coxen's fig-parrot habitat;
- implement a community awareness strategy; and
- manage the recovery process.

Estimated Costs of Recovery

The estimated costs of recovery are shown in Table 1.

Table 1. *Estimated costs of recovery ($'000s/year).*

Action	1	2	3	4	5	6	Total
2001	80.0	165.5	16.0	50.5	9.0	20.0	341.0
2002	47.5	83.0	16.0	30.5	7.0	20.0	204.0
2003	22.5	54.0	2.0	24.5	7.0	20.0	130.0
2004	12.0	49.0	0.0	22.0	5.0	20.0	108.0
2005	10.0	59.0	0.0	22.0	5.0	20.0	116.0
Total	172.0	410.5	34.0	149.5	33.0	100.0	899.0

Biodiversity Benefits

The decline of Coxen's fig-parrot emphasises the importance of habitat conservation, the need to maintain habitat connectivity and the conservation of biodiversity. The conservation and study of Coxen's fig-parrot will also serve to protect and enhance poorly conserved lowland rainforest remnants in south-east Queensland and north-east New South Wales. A diverse range of fauna will benefit, including other frugivorous species such as fruit-doves and pigeons, Queensland tube-nosed bat *Nyctimene robinsoni* and flying-foxes *Pteropus* spp. Conservation of dry rainforest habitats, in particular, will greatly promote the recovery of the black-breasted button-quail *Turnix melanogaster*. Through awareness of the plight of Coxen's fig-parrot and the opportunity to participate in its recovery, the profile of all threatened species is raised in the general community. This in turn leads to greater opportunities for the conservation of threatened species and increased protection of biodiversity.

1 Current conservation status

Coxen's fig-parrot *Cyclopsitta diophthalma coxeni* Gould of the family Psittacidae is currently known only from a relatively small number of records – around 30 sightings since 1970 in north-east New South Wales and twice as many since 1990 in south-east Queensland. Thus, a confident estimation of the number and size of the existing populations is not possible. Historical records indicate that the subspecies once inhabited lowland rainforest from the Mary River in Queensland to the lower Richmond River and possibly the Macleay River in New South Wales. Predictions by computer models and recent, credible, but largely unconfirmed sightings suggest its range may extend further north and south than was previously thought. Although probably never common historically, the population appears to have declined to critical levels due to widespread loss of habitat around the turn of the twentieth century. Remaining habitat is fragmented. Surveys conducted in 1985, 1987-1989, and 1996-7 located only a few individuals and found limited evidence of the bird's presence. Surveys by Holmes from 1993-1995 found no birds at all (Holmes 1995). Sporadic incidental sightings by members of the public continue to be reported across the bird's distribution suggesting the population is persisting, even if in very low numbers.

Coxen's fig-parrot is listed as endangered under the New South Wales *Threatened Species Conservation Act 1995*, the Queensland *Nature Conservation (Wildlife) Regulation 1994,* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* because it is likely to become extinct unless threatening processes are removed. The subspecies meets the criteria for critically endangered status under the International Union for the Conservation of Nature (IUCN SSC 1994) categories of threat (Category C2a). Coxen's fig-parrot is also listed as critically endangered by ANZECC (1995) and Garnett and Crowley (2000).

2 Description

2.1 Description

Coxen's fig-parrot is an attractive, small, predominantly green parrot whose seemingly over-large head and bill, together with an extremely short tail, give it a somewhat dumpy, top-heavy appearance resembling an exotic lovebird (*Agapornis* spp.). It attains a length of 16cm (Pizzey and Knight 1997). Both sexes are rich green above and yellowish-green below with a yellow-sided upper breast and flanks. The wings are green with the outer sections of the primary feathers dark blue and inner sections dark grey. The edges of the tertial feathers are red. The bill is two-toned: pale grey with a dark grey or black tip. The eye is brown. The male has a distinctive blue forehead surrounded by a few red feathers and an orange-red cheek patch bordered below by a mauve-blue band. The female is similar but with a smaller blue forehead patch with less or no red, and a duller, smaller orange-red cheek patch (Forshaw 1981, Pizzey and Knight 1997). Immatures and juveniles have not been described.

Coxen's fig-parrot can be confused with several species of lorikeet, particularly the little lorikeet *Glossopsitta pusilla* and the musk lorikeet *G. concinna.* However, the build, size, bill colour, distinctive head, breast and wing markings, and absence of brown nape and mantle are useful distinguishing features. Furthermore, fig-parrots and lorikeets look and behave differently in flight. The fig-parrot's dumpier build, broader, more rounded wings and almost tail-less silhouette contrast with the overall slimmer, small-headed appearance and the longer, finer and more pointed wings of both the little and musk lorikeets (Norris 1964, Corfe 1977). The flight of the Coxen's fig-parrot is rapid and direct (Norris 1964, Corfe 1977, Peddie in Lendon 1979). Like the related red-browed fig-parrot (*C. d. macleayana*), it presumably does not adopt the lorikeet style of "darting and dodging through gaps in the branches and foliage of the tree-tops" (Bourke and Austin 1947, Forshaw 1981).

The flight call of Coxen's fig-parrot is a short, clipped, two note call, variously described as a high-pitched 'zeet-zeet' (Slater *et al*. 1986, Pizzey and Knight 1997), 'tcheek, tcheek' (Norris 1964), 'yyit-yyit' (Corfe 1977), a medium-pitched 'zzzt-zzzt' (Martindale 1986), or a rather soft lorikeet-like screech (CSIRO 1996). This call is reputedly indistinguishable from that of other Australian subspecies of fig-parrot (Parker in Holmes 1990), but is harsher and more staccato than the screech of a little lorikeet (Martindale 1986). Coxen's fig-parrot does not always call while in flight (Brenan 1924, Peddie in Lendon 1979).

2.2 Taxonomy

Coxen's fig-parrot is the largest subspecies of Australia's smallest parrot, the double-eyed fig-parrot. The name "double-eyed fig-parrot" refers to the colourful cheek patches. Coxen's fig-parrot was the first of the three geographically discrete Australian subspecies to be recognised. Gould described it in 1867 from skins collected in 1866 by a sawyer at Mount Samson near Brisbane. The other two subspecies are the red-browed fig-parrot *C*. *d*. *macleayana* Ramsay 1874, from Cooktown south to around Cairns, the Atherton Tableland and Paluma in north-east Queensland, and Marshall's fig-parrot *C*. *d*. *marshalli* (Iredale 1947) from eastern Cape York Peninsula (Forshaw 1981). In addition, five subspecies of double-eyed fig-parrot, including the nominate form, are distributed through New Guinea and the Aru Islands of Indonesia (Forshaw 1989).

All eight subspecies of double-eyed fig-parrot possess bright head markings which exhibit some sexual dimorphism. However, in Coxen's fig-parrot this dimorphism is not pronounced (Forshaw 1967). Suggestions that Coxen's fig-parrot is a separate species, based upon its large size and almost entirely blue forehead in both sexes (e.g. Rothschild and Hartert 1901, Mathews 1946) were rejected by Forshaw (1967). However, Keast (1961) recognised that it is approaching the degree of morphological differentiation that is typical of a species and recent unpublished reports of the larger size of Coxen's fig-parrot eggs and the unique shell morphology, as compared to eggs of red-browed fig-parrot and Marshall's fig-parrot (J. Young pers. comm.), suggest a reconsideration of the taxonomy of *C. d. coxeni* is required. It is expected that detailed genetic analysis will resolve the taxonomic status of Coxen's fig-parrot.

Although currently considered to belong to *Cyclopsitta*, in the past the double-eyed fig-parrot has been assigned to several other genera. These were *Psittacula*, *Opopsitta* and *Psittaculirostris*.

3 Distribution

3.1 Current and historical distribution

Coxen's fig-parrot is currently only known in the wild from approximately 90 reliable records in Queensland since 1970 and about 30 such sightings in New South Wales over the same period (Martindale 1986, Holmes 1990, 1995, Gynther 1996a,b, Horton 1996, Gynther *et al.* 1998, and I. Gynther pers. comm.). Figures 1 and 2 depict selected sighting localities in the two states.

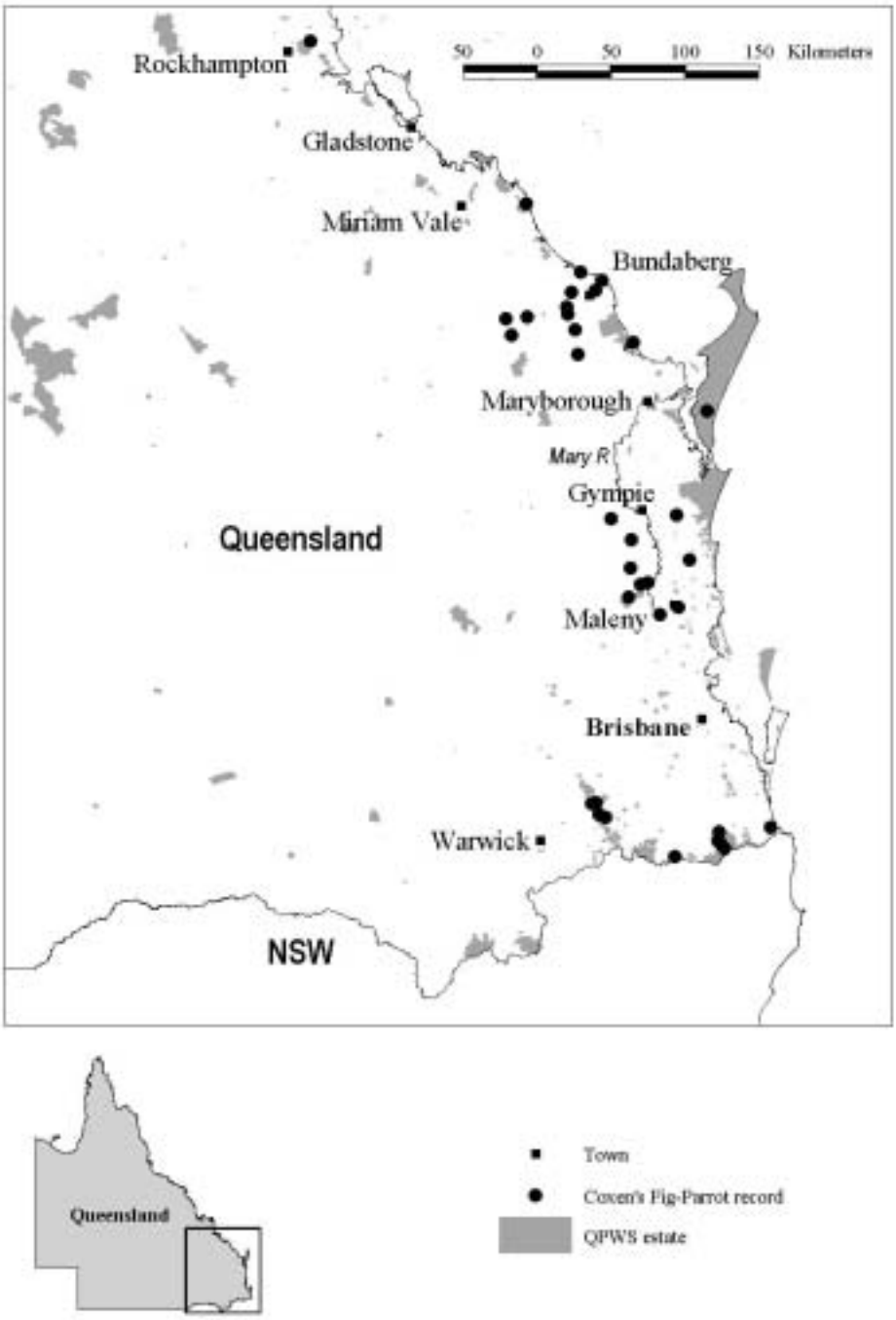
The historical distribution of Coxen's fig-parrot is blurred. The accepted core range is from Gympie in south-east Queensland to the Richmond River in north-east New South Wales and as far west as the Bunya Mountains and the Koreelah Range (Holmes 1990, Garnett 1992). This range may have extended to Maryborough in the north and the Macleay River in the south (Forshaw 1981, 1989, Blakers *et al.* 1984), although these limits are based on published records (De Warren 1928, Kinghorn 1936) that are not universally accepted.

A BIOCLIM analysis of documented locations of Coxen's fig-parrot yielded a potential distribution from the Boyne River near Gladstone (24°00'S) south to the Williams River (32°20'S) near Barrington Tops (Holmes 1990). This lends support to recent (or recently acquired) credible but largely unsubstantiated records from as far north as the Rockhampton district, Granite Creek State Forest and Deepwater National Park in Queensland and as far south as the Hastings River catchment in New South Wales (Holmes 1995, Gynther *et al.* 1998, I. Gynther pers. comm). It also suggests that previously discounted records from the Mann and Macleay Rivers of New South Wales (Holmes 1990) warrant further investigation.

Coxen's fig-parrot was once thought to have suffered a relatively recent range reduction (Martindale 1986). However, the number and geographic spread of recent records now indicate it may be thinly but widely distributed or in small subpopulations throughout a much broader range than was recognised historically. The most recent reliable records from Queensland are: Deepwater National Park (May 1997), Moore Park (February 1997 - March 1998), Burnett Heads (February 1998), East Bundaberg (November/December 1997), Gin Gin (April 1997 - February 2001), Farnsfield (1997), Childers (September 1997), Kin Kin (July 1999 - November 2000), Upper Pinbarren Creek (January - March 2001), Eumundi (1997 - 1998), Mt Borumba (May 1997), Kenilworth (October 1997), the Maleny area (December 1997 - February 2001), Main Range National Park (September and October 1997) and Lamington National Park in January and November 1998 (Gynther *et al.* 1998, I. Gynther pers. comm.).

In New South Wales, recent credible records exist from Uki (November 1999), Mebbin State Forest (January-February 1995), Whian Whian State Forest (January-February 1995 and August 1996 - December 1998), Eltham (April 1995), Richmond Range National Park (November 1995) and from 1996-1998 in the Hastings River area (CSIRO 1996, Horton 1996, D. Charley pers. comm., J. Young pers. comm.).

***Figure 1**. Selected records of Coxen's fig-parrot in Queensland since 1990.*



Note: Source information from Holmes (1994a, 1995), Gynther *et al*. (1998), I. Gynther (pers. comm.)

Figure 2. *Selected records of Coxen's Fig-Parrot in New South Wales.*

★ Coxen's fig-parrot records

State Forests of NSW

National Parks of NSW

Note: Source information from Holmes (1990, 1994a, 1995)

N

Nest site surveys (Gynther 1996a, Gynther and O'Reilly 1998, Gynther *et al*. 1998) have detected evidence of current or past Coxen's fig-parrot breeding activity in the form of

completed or partially excavated nest holes at eight localities. In Queensland, nesting signs were discovered in Kenilworth State Forest, Lamington National Park and Main Range National Park (all August 1996) and in Conondale National Park (October 1998). In New South Wales, breeding evidence was found in Mebbin State Forest, Tooloom National Park and the Tyalgum area in August 1996 and in Toonumbar National Park in September 1997. Signs of recent (post-1995) nesting activity were present at four sites. In Lamington National Park, nest excavations were probably made less than a week prior to their discovery in 1996, although the site was not subsequently used. To date, no active nest has been found.

The suspected range of Coxen's fig-parrot in Queensland includes the following local government areas (LGAs):

Beaudesert Shire, Biggenden Shire, Boonah Shire, Brisbane City, Bundaberg City, Burnett Shire, Caboolture Shire, Calliope Shire, Caloundra City, Cambooya Shire, Clifton Shire, Cooloola Shire, Crows Nest Shire, Esk Shire, Gatton Shire, Gold Coast City, Hervey Bay City, Ipswich City, Isis Shire, Kilcoy Shire, Kilkivan Shire, Kingaroy Shire, Kolan Shire, Laidley Shire, Maroochy Shire, Maryborough City, Miriam Vale Shire, Nanango Shire, Noosa Shire, Perry Shire, Pine Rivers Shire, Rosalie Shire, Tiaro Shire, Toowoomba City, Wambo Shire, Warwick Shire, Woocoo Shire.

The suspected range of the subspecies in New South Wales includes the following LGAs:

Ballina Shire, Bellingen Shire, Byron Shire, Camden Haven Shire, Casino Shire, Coffs Harbour City, Copmanhurst Shire, Dumaresq Shire, Grafton City, Guyra Shire, Hastings Shire, Kempsey Shire, Kyogle Shire, Lismore City, Maclean Shire, Nambucca Shire, Nymboida Shire, Richmond River Shire, Severn Shire, Tenterfield Shire, Tweed Shire, Ulmarra Shire, Walcha Shire**.**

3.2 Tenure

In New South Wales, most Coxen's fig-parrot records and large habitat areas are on public lands (national parks and state forests). This is also the situation in Queensland, although many sightings from the Gympie area northwards are on freehold land.

Coxen's fig-parrot has been recorded from the following conservation reserves:

Queensland	New South Wales
National Parks:	*National Parks:*
Bunya Mountains National Park	Border Ranges National Park
Burrum Coast National Park	Nightcap National Park
Conondale National Park	Richmond Range National Park
Deepwater National Park	Tooloom National Park
Great Sandy National Park	Toonumbar National Park
Lamington National Park	
Main Range National Park	*Nature Reserves:*
Mapleton Falls National Park	Boatharbour Nature Reserve
Mount Pinbarren National Park	Booyong Nature Reserve

It should be noted that because the bird is itinerant by nature, records from within a conservation reserve do not necessarily represent a conserved population.

4 Habitat

4.1 Habitat preferences

Coxen's fig-parrots probably preferred lowland subtropical rainforests such as those found in the Big Scrub remnants around Lismore, the foothills west of Brisbane and lowland rainforests north to the Mary River (Holmes 1994b). Within these forests, alluvial areas where figs and other fleshy-fruited trees are prevalent are probably preferred (Martindale 1986, Holmes 1990). Gallery rainforest was probably also important (Holmes 1990). As much of this rainforest type has been cleared since European settlement, the remnants are fragmented, more hilly and consequently drier (Martindale 1986). They support fewer fleshy-fruited trees (Floyd 1977) and, as a result, may support lower densities of fig-parrots than the original lowland forests (J. Martindale pers. comm.).

Recent records of Coxen's fig-parrots are from subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, sub-littoral mixed scrub, riparian corridors in woodland, open woodland and otherwise cleared land, and urbanised and agricultural areas with fig trees. These sightings span a range of altitudes from sea level to about 900m above sea level. Areas with a high fig diversity, where fruiting is staggered along moisture and altitudinal gradients, may be favoured. Most records are from small remnant stands, forest edges (Holmes 1994a) or thin strips of gallery forest (Norris 1964). The apparent distribution of these recent records and conclusions on habitat preference must be viewed with caution since the cryptic nature of the species makes it easy to overlook and, therefore, potentially subject to observer bias.

Nests are reported within subtropical rainforest, dry rainforest and also from ecotones between sclerophyll forest and subtropical rainforest (J. Young pers. comm.). These ecotones may form an important part of the bird's habitat (J. Young pers. comm.). Coxen's fig-parrot has also been reported visiting fruiting trees in gardens and cultivated farmlands (Forshaw 1969, Morris and McGill 1980, Fisher in Holmes 1990, Gynther *et al*. 1998).

4.2 Habitats critical to survival

Given the poor state of knowledge about the distribution, patterns of movement and ecology of Coxen's fig-parrot, it is not yet possible to state definitively what constitutes habitat that is critical to the survival of the taxon or to accurately map the distribution of such habitat.

The presence of abundant fig trees appears to be an important factor governing the subspecies' occurrence. However, as fig trees exist at apparently suitable densities across a wide range of habitats, landscapes and disturbance regimes (see 4.1), it would be inappropriate to identify and map all these ecosystems as being critical to the bird's survival. Nevertheless, the mapping of fig trees is recognised in this recovery plan (see 10.3.1) as a necessary prelude to the identification and protection of such key habitats. Other actions described in this plan will assess the importance of specific habitat types for feeding and nesting at and adjacent to sites occupied by Coxen's fig-parrot. These actions will complement the fig tree mapping and lead to a better understanding of all habitat attributes that may be critical to survival of the subspecies.

5 Ecology

5.1 Life history

The life history and ecology of Coxen's fig-parrot are largely unknown. Information is pieced together from incidental sightings and, where appropriate and possible, extrapolated from knowledge of the other subspecies. Holmes (1990, 1994a, 1995) summarises knowledge currently available.

Coxen's fig-parrot is a cryptic species. Most observations are of single birds or pairs feeding in fruiting trees or flying above the forest canopy. However, it is easy to overlook small, green birds living high among the foliage of canopy trees (Forshaw 1981). Even when the birds are known to be present in a tree, they can be impossible to detect (Norris 1964). To compound this problem, Coxen's fig-parrots feed quietly, moving swiftly and silently along the branches (Brenan 1924, Waller in Chisholm 1924, Irby 1930). Often they are only detected by the continual stream of fruit debris, the unwanted pulp of figs, falling to the ground (Chisholm 1924). The soft chattering of feeding red-browed fig-parrots (Bourke and Austin 1947) has not been described for Coxen's fig-parrots.

Individual fruiting trees may form important habitat components, especially during the breeding season. On the Sarabah Range, a rusty fig *Ficus rubiginosa* was visited for at least a week in September 1982, and a deciduous fig *F. superba* for three successive days in January of both 1982 and 1983. A Moreton Bay fig *F. macrophylla* in the Conondale Ranges was visited in October and November of successive years (Holmes 1990). Recent anecdotal evidence from the Bundaberg area in Queensland may indicate regular usage of individual trees until the fruit reserves are exhausted (Gynther *et al*. 1998).

Although Holmes (1990) suggests Coxen's fig-parrots are seasonal, altitudinal migrants, this may be an artefact of habitat decline and an assumption incorrectly based on the limited number of reported sightings. Whether any such movements occur is presumably determined by the local availability of food. Where food resources are capable of supporting a subpopulation throughout the year, altitudinal migrations appear to be reduced or absent (I. Gynther pers. comm.).

In some highland areas, birds may move to progressively higher altitudes from August to February following the wave of ripening fruit through the rainforests (Holmes 1995). All sightings in the Sarabah Range occurred during this period (Holmes 1990). As summer wanes, the wave of ripening fig and other fruit retreats to the lowlands from March to about October and the fig-parrots may follow. Lowland figs, which produce some fruit all year, have a winter fruiting peak (Storey 1994, S. Horton pers. comm., L. Jessup pers. comm.). At this time, fig-parrots may travel in search of food in small flocks (Holmes 1990). The largest 'winter' flock sighted in the past 25 years contained seven birds (Holmes 1990). During summer, the birds may occur more regularly in pairs.

The home range size of fig-parrots during either breeding or non-breeding seasons is unknown. Red-browed and Marshall's fig-parrots habitually form communal overnight roosts of up to 200 birds in particular trees (Bourke and Austin 1947, Forshaw 1969, 1981, Holmes 1995). Communal roosting is not known for Coxen's fig-parrot but Holmes (1995) speculates that it may once have occurred. Furthermore, he suggests that if the population is now so low that communal roosting is precluded, the loss of social interaction and consequent ability to locate food sources may be a contributing factor to the subspecies' apparent ongoing decline.

5.2 Food

Fig-parrots are omnivorous. They feed mainly on seeds of near ripe or ripe fruits of native figs, and/or insect larvae, which may include the fig wasp (Forshaw 1981, Romer and Spittall 1994, Pizzey and Knight 1997).

Favoured species are the Moreton Bay fig *Ficus macrophylla* and green-leaved strangler fig *F. watkinsiana,* but other species also eaten include rusty fig *F. rubiginosa*, white fig *F. virens*, small-leaved fig *F. obliqua,* cluster fig *F. racemosa,* the sandpaper figs *F. coronata, F. opposita* and *F. fraseri* and deciduous fig *F. superba* (Holmes 1990, Gynther *et al*. 1998, I. Gynther pers. comm.).

Native fruits also probably eaten are sour cherry *Syzygium corynanthum*, blue quandong *Elaeocarpus grandis* and bolly gum *Litsea reticulata* (Benfer in Chisholm 1924, Irby 1930, Holmes 1990). Other likely food sources include other lilly-pillies (*Syzygium* spp., *Acmena* spp.) and red ash *Alphitonia excelsa* (Holmes 1990). Silky oak *Grevillea robusta* nectar is reportedly eaten as well (Irby 1930). Consumption of lichens may supply a source of zinc (Romer and Spittall 1994).

Coxen's fig-parrot is also known to feed on exotic plants. These include edible fig *F. carica,* cotoneaster *Cotoneaster lacteus* and queen palm *Syagrus romanzoffiana* in gardens (Holmes 1990, Gynther *et al*. 1998), and loquat *Eriobotrya japonica* on farmland (Forshaw 1969). Such introduced species may be used when native food is in short supply (Holmes 1990).

5.3 Nest and eggs

Coxen's fig-parrots, like their related subspecies, are thought to nest in high trees usually within or near the edge of rainforest, although there are a few unconfirmed records from eucalypts some distance away. Like those of their northern counterparts, the nest chamber is excavated on the underside of a dead or decaying limb or trunk in a living or dead tree (Holmes 1995, Pizzey and Knight 1997, J. Young pers. Comm.). Nest construction is thought to begin in August (Gynther 1996a, J. Young pers. comm.) and breeding occurs from October to December or January (Holmes 1990, 1995). The normal clutch size is probably two (Holmes 1995, Pizzey and Knight 1997). Incubation and fledging details are unknown for Coxen's fig-parrot but, in captivity, red-browed fig-parrots incubate clutches for approximately 20-24 days and their young fledge after about 36-42 days (Romer and Spittall 1994).

5.4 Predators

Although no published information is available, predators of Coxen's fig-parrot are expected to include the brown goshawk *Accipiter fasciatus,* grey goshawk *A. novaehollandiae,* collared sparrowhawk *A. cirrocephalus*, sooty owl *Tyto tenebricosa* and southern boobook *Ninox novaeseelandiae* (J. Young pers. comm.).

6 Listing of the species

6.1 Historical decline

The decline of Coxen's fig-parrot was probably due to the clearing of lowland subtropical rainforest for agriculture and housing from the 1860s to around the start of the twentieth century and then to the logging of rainforest timbers until 1984 (Illidge 1924, Cayley 1938, Martindale 1986). However, Irby (1930), who encountered the species several times in the Richmond and Tweed River valleys of New South Wales, disagreed. She wrote that while "they were never numerous", she considered they were not any rarer then than 20 years earlier "when our vanishing scrubs still covered many a thousand acres now given over to crops and grass". Nonetheless, Coxen's fig-parrot, like many other species, probably suffered a corresponding reduction in population numbers and range. Although a significant proportion of the hilly, higher altitude lowland subtropical rainforest is protected within formal conservation reserves, the near coastal, gently sloping, lowland subtropical rainforest such as the Big Scrub of north-east New South Wales has suffered substantial fragmentation and is poorly reserved (Martindale 1986).

6.2 Current threats

The suspected ongoing decline of the subspecies, ascertained from the paucity of sighting records despite the targeted surveys described by Martindale (1986, 1996), Holmes (1990, 1995), Gynther (1996a,b), Gynther and O'Reilly (1998) and Gynther *et al*. (1998) and more

general, community-based surveys in Queensland and New South Wales (Gynther *et al*. 1998), may be caused by:

- inadequate extent and quality of habitat;
- loss of connectivity between summer and winter areas;
- fragmented habitat requiring birds to cross open areas;
- disturbance to some suspected ecotonal breeding areas;
- disjunct feeding grounds leading to difficulties in finding food;
- low numbers, preventing a social breeding trigger being activated;
- intermittent food discontinuity causing a gap in food availability during the year;
- low numbers limiting an energy efficient communal food search effort;
- increased competition;
- potential change to social structures following population decline;
- disease; and
- stochastic events, such as drought, which may have severe impacts upon low populations.

Currently, the bird may be threatened by degradation of feeding and nesting habitat by weeds, particularly in the lowland riparian subtropical rainforest remnants where figs and other fleshy-fruited rainforest trees are most concentrated (Joseph 1988, Garnett 1992, Garnett and Crowley 2000, A. Floyd pers. comm., S. Horton pers. comm., R.J. Hunter pers. comm., L. Jessup pers. comm., P. Young pers. comm.). Significant invasion by cat's claw creeper *Macfadyena unguis-cati* of gallery rainforest near Bundaberg has been noted by I. Gynther (pers. comm.) in the vicinity of recent fig-parrot sightings.

In New South Wales, the threat caused by fragmented habitat may be slowly easing as a result of government and privately sponsored community rainforest reforestation programs. Many earlier planted rainforest areas and gardens are now maturing and producing fruit (S. Horton pers. comm., R.J. Hunter pers. comm.). However, most of the potential habitat for the fig-parrot still remains degraded. In New South Wales, J.B. Williams (pers. comm.) believes that lowland subtropical rainforests are increasing in both area and species diversity, while in southern coastal Queensland, loss of lowland subtropical rainforest has probably stabilised and rehabilitation programs are beginning (P. Young pers. comm.).

Logging and associated disturbance of the subtropical rainforest/eucalypt ecotones thought to be part of the breeding habitat may also be a threat for the subspecies. Forshaw (1981) emphasises the special need to protect the rainforest edge where burning, clearing or logging operations not specifically targeted at the rainforest can be particularly damaging.

Mature figs that remain as isolated paddock or shade trees on agricultural or other land (e.g. council parks and reserves) probably form an important winter food source (J. Young pers. comm.). A potential threat is lack of recruitment to these isolated groups of figs.

The rarity of Coxen's fig-parrot in the wild and its apparent absence in captivity probably make it highly desirable to illegal egg collectors and aviculturists. Thus, illegal robbing of nests for eggs, young and adults is a substantial additional threat (Holmes 1990). A considerable black market for this taxon, particularly overseas, undoubtedly exists.

Whilst many reasons for the apparent decline in Coxen's fig-parrot numbers may never be known or accurately quantified, studies of related subspecies may provide some clues. The cryptic nature of the bird also means that any conclusions on previous habitat or altitudinal requirements of the species must be viewed with caution because of the potential for observer bias. It is possible that the quantity of habitat remaining may be more critical for the species than the altitudinal distribution of the habitat (D. Charley pers. comm.).

6.3 Social and economic impacts
The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts.

6.4 International obligations
Although Coxen's fig-parrot is listed in Appendix I of CITES, this recovery plan does not affect Australia's obligations under international agreements.

6.5 Role and interests of indigenous people
Indigenous communities involved in the regions affected by this plan have not yet been identified. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region.

7 Existing conservation measures

7.1 Recovery history
7.1.1 Assessment and research
- 1985/86. RAOU, ANCA and Currumbin Wildlife Sanctuary review of records and field survey of NSW/Qld border area (Martindale 1986).

- 1987-present. Implementation of trial captive breeding program by Currumbin Wildlife Sanctuary using red-browed fig-parrots as analogues. Research ongoing. Over seven years to 1999, 37 progeny raised (S. Goldie pers. comm.).

- 1987-1989. Survey in Qld and NSW and preparation of a summary of known biology and ecology (Holmes 1990) (Sponsored by NSW NPWS and Currumbin Wildlife Sanctuary).

- 1992. Subspecies Recovery Outline produced as part of *The Action Plan for Australian Birds* (Garnett 1992).

- 1993. Preparation of the first recovery plan by the Qld Dept of Environment and Heritage under ANCA's Endangered Species Program (Davidson 1993).

- 1993. Formation of the Coxen's Fig-Parrot Recovery Team and implementation of recovery plan. The team included staff from NSW NPWS, SF NSW, O'Reilly's Rainforest Guesthouse (Qld), the then Dept of Environment and Heritage (Qld), Currumbin Wildlife Sanctuary (Qld), Queensland Museum and Environment Australia.

- 1993-1995. Additional cross-border field survey of potential fig-parrot habitat under a research grant agreement administered by the Qld Dept of Environment and Heritage. No records of Coxen's fig-parrot were obtained during the survey period; however, information on a number of plausible past and concurrent reports was gathered (Holmes 1994a, 1995). The primary approach adopted during these and earlier surveys was to scan fruiting fig trees in the hope of locating fig-parrots feeding among the branches or flying to and from the tree.

- 1994. Completion of a ten-month study of the seasonal patterns of fruiting by figs in lowland and upland rainforest in an area of south-east Qld by a Griffith University postgraduate student (Storey 1994).

- 1996. Habitat mapping of canopy height fig trees around the seven most recent, plausible records in NSW (Horton 1996).

- 1996. Examination of grey goshawk prey remains in areas of potential Coxen's fig-parrot habitat. No Coxen's fig-parrot remains were identified (D. Charley pers. comm.).

- 1996. Design of a “Coxen’s fig-parrot Sighting Report Form” (Appendix 3).

- 1996. Identification of potential lowland habitats of Coxen’s fig-parrot by a Southern Cross University student. The aim of this project was to map the distribution of large fig trees in the Lismore area through interpretation of aerial photos and ground-truthing (Jago 1997).

- August 1996. Two week confidential nest site search and training exercise undertaken (Gynther 1996a). Evidence of current and past nesting activity was located at seven sites (four in Qld, three in NSW), although no birds were observed.

- Sept.-Nov. 1996. Follow up nest searches conducted (Gynther 1996b). Additional evidence of past nesting activity in the form of old nest holes was discovered at one Qld locality (Lamington National Park).

- 1996/1997. Caged red-browed fig-parrots used as potential decoys at a fixed site at O’Reilly’s Rainforest Guesthouse during summer. The birds were housed on the rainforest floor beneath fruiting fig trees but no Coxen's fig-parrots were located (P. O’Reilly pers. comm.).

- 1996, 1997. Caged red-browed fig-parrots hoisted into canopy of fruiting figs as potential Coxen's fig-parrot decoys at one site in NSW (Cambridge Plateau). Monitoring of the caged birds yielded no sightings (Martindale 1996).

- 1997. Draft guidelines formulated for establishment and operation of a Coxen’s fig-parrot Records Appraisal Committee to appraise incidental sightings.

- June-Aug. 1997. Surveys for past nest sites conducted in Qld during the non-breeding season. High quality habitat identified in the greater Bundaberg area (Gynther *et al*. 1998).

- Aug.-Sept. 1997. Two week confidential nest site search and nest search training exercise. Two birds flew overhead at a site in Main Range National Park and a new nesting locality was discovered in NSW (Toonumbar National Park). Birds were not located at an active nest (Gynther *et al*. 1998).

- Sept.-Dec. 1997. Follow up survey work in Qld and NSW. No birds or additional evidence of nesting activity were discovered (Gynther *et al*. 1998).

- November 1997. Community survey of fruiting fig trees in Cambridge Plateau and Mebbin State Forest conducted. Birds were not sighted (Gynther *et al*. 1998).

- 1997-1998. Detailed mapping by Terrafocus of fig trees on farmlands in the Byron Shire, NSW to determine strategic habitat corridor locations for a tree planting project.

- Jan.-Feb. 1998. Caged decoy birds reinstalled at a fixed site on the Sarabah Range, Qld by Currumbin Wildlife Sanctuary and O’Reilly’s Rainforest Guesthouse. No Coxen’s fig-parrots were observed (P. O’Reilly pers. comm.).

- March 1998. Community survey of fruiting fig trees conducted in the Bundaberg area, Qld. Coxen's fig-parrot was not actually located during the survey but 14 previously undocumented and credible anecdotal sightings were obtained as a result of the associated media attention. An aerial survey of adjacent habitat was also conducted (Gynther *et al*. 1998).

- Sept.-Dec. 1998. Surveys conducted across 14 localities in south-east Qld. Birds were not sighted, however a past nest hole (approximately 2 years old) was discovered in Conondale National Park, a previously undocumented breeding locality (Gynther and O'Reilly 1998).

- Oct. 1999-June 2000. Detailed mapping of fig trees on farmlands in Lismore and Kyogle LGAs undertaken. Proposed to be extended in 2000-2001 to include Ballina, Richmond Valley and Tenterfield LGAs.

- 2000. Revised subspecies Recovery Outline produced as part of *The Action Plan for Australian Birds 2000* (Garnett and Crowley 2000).

- 2001. Southern Cross University provided with funds by NSW NPWS to commence a genetic investigation of the subspecies of double-eyed fig-parrot.

7.1.2 Habitat rehabilitation

- Sept. 1999 and ongoing. Implementation of community fig tree planting program by NSW NPWS, Big Scrub Rainforest Landcare Group and Byron Shire Council in the Byron, Ballina, Casino, Richmond River, Lismore and Kyogle LGAs. Funding supplied jointly by NSW NPWS and Threatened Species Network Community Grants (supported by the Endangered Species Program of the Natural Heritage Trust) with trees being grown by SF NSW and Environmental Training and Employment (Northern Rivers) Inc.

- 1999. The Bundaberg Branch of the Bird Observers Club of Australia successfully obtained a grant of $5,000 from the Threatened Species Network Community Grants Scheme for a fig tree planting project on Burnett Shire Council land at Moore Park, Qld.

- 2001. Natural Heritage Trust funding secured for "Trees on Farms" project (Mr Terry Moodie) to undertake further fig tree planting in northeast NSW.

- 2001. Community group 'Save Today Our Parkland' awarded a $20,000 grant from the Threatened Species Network Community Grants Scheme for a habitat rehabilitation and revegetation program focusing on remnant gallery rainforest at sites along Kin Kin and Upper Pinbarren Creeks in the Noosa hinterland of southeast Qld.

7.1.3 Public education and information

- Articles published in ornithological and natural history magazines (Holmes 1987a,b, 1994b, Anon. 1990, Romer and Gynther 1997, Gynther 1999, Romer 1999).

- Exposure to the international avicultural community through liaison with and funding by The World Parrot Trust.

- Joint production and distribution in 1993 of 10,000 colour brochures by Currumbin Wildlife Sanctuary and the Qld Dept of Environment and Heritage to highlight the parrot's decline and outline the recovery process.

- Media coverage via Qld and NSW statewide radio, television and newspaper articles and community-based newsletters.

- Presentations to ornithological, natural history, avicultural and Landcare groups.

- The Coxen's fig-parrot recovery program was the beneficiary of the Queensland Ornithological Society Inc.'s 1996 Twitchathon appeal.

- Wildlife documentaries on national and local television sponsored by Currumbin Wildlife Sanctuary.

- June 1998. Inclusion of Coxen's fig-parrot in an endangered species display at the Queensland Museum.

- 1998. Production of Coxen's fig-parrot T-shirt and sloppy joes for awareness and fund-raising.

- 1998. Design, production and distribution of an updated colour brochure by the recovery team and Currumbin Wildlife Sanctuary.

- 1998. Joint production of a "fridge flyer" in the Bundaberg area by the Parrot Society of Australia, Currumbin Wildlife Sanctuary and the Bundaberg Branch of the Bird Observers Club of Australia (Gynther *et al*. 1998).

- Aug. 1998. Delivery of a paper describing the recovery program at the South-East Queensland Rainforest Recovery Conference, Tannum Sands, Qld (O'Reilly 1999).

- Feb. 1999. Presentation on the recovery program at a joint Coxen's fig-parrot/Richmond birdwing butterfly seminar to local government environment officers from across southeast Qld and northeast NSW. The event was hosted by Gold Coast City Council.

- 1999. Production of 5000 colour posters by the Lismore District of NSW NPWS for general distribution in both states. The poster was reprinted in 2001.

8 Taxon's ability to recover

The decline of Coxen's fig-parrot since European settlement has undoubtedly been accelerated by human-induced causes. Available information is inadequate to predict the subspecies' ability to recover. However, indications from certain other parrot species are that recovery will take some time, even after threatening processes are removed or mitigated (J. Martindale pers. comm.).

In the absence of significant population recoveries in the wild within reasonable timeframes, captive breeding has been shown to be an effective way of increasing populations of other critically endangered bird species, both in Australia and overseas. Captive breeding was used with exceptional success in the recovery of the Lord Howe woodhen *Gallirallus sylvestris* (Miller and Mullette 1985). Currently in Australia it forms part of the recovery strategy for the helmeted honeyeater *Lichenostomus melanops cassidix* (Smales *et al.* 1995), regent honeyeater *Xanthomyza phrygia* (Menkhorst *et al*. 1998) and orange-bellied parrot *Neophema chrysogaster* (Rounsevell 1996). The need for captive breeding of Coxen's fig-parrot has been identified in both the subspecies' Recovery Outline (Garnett and Crowley 2000) and the previous recovery plan (Davidson 1993).

Other recovery actions to conserve and enhance habitat and re-establish corridors will by necessity take time. Consequently, any release of captive-bred *C. d. coxeni* can only be

considered in the long term. The main short-term aim of establishing a founder group in captivity would be to reduce the risk of extinction of the subspecies in the wild before all processes threatening the bird can be identified and removed.

Captive breeding and release of Coxen's fig-parrot is not possible until wild birds are obtained to provide the parental stock, probably in the form of eggs or chicks removed from a nest. More opportunistic sources of stock may be injured birds found by the public or abandoned chicks found at fallen or flooded nests. Nevertheless, captive husbandry techniques and protocols have been developed since 1987 in Queensland at Currumbin Wildlife Sanctuary on the closely related taxon *C. d. macleayana* in case the opportunity to house Coxen's fig-parrot in captivity arises (Romer and Spittall 1994). Further development of, and agreement on, these protocols is required before considering their implementation.

Joseph (1988) has suggested that captive breeding may warrant being given a higher priority than conserving existing habitat or populations of Coxen's fig-parrot. Resolving these priorities and deciding on an appropriate time for active intervention are important responsibilities of the recovery team and will be undertaken in full consultation with relevant scientific and ethics committees, as well as acknowledged experts in the avicultural and general communities.

9 Recovery objectives and criteria

9.1 Recovery objectives

The overall objective of this recovery plan is to prevent extinction of Coxen's fig-parrot from human-induced causes and ensure the stability of wild populations.

Specific objectives during the life of the current recovery plan are to:

- locate one or more remaining populations;
- protect remaining populations and their habitat from human-induced threatening processes, thereby maintaining the populations and habitat;
- increase understanding of the ecology of Coxen's fig-parrot;
- secure and breed a captive population of Coxen's fig-parrot;
- increase the extent, quality and connectivity of the habitat of Coxen's fig-parrot.

9.2 Recovery criteria

The success of the recovery program will be assessed against the following criteria:

- at least one remaining population is located;
- ecological assessment and monitoring strategies are established;
- wild populations have not suffered reduction as a result of any factors other than stochastic events;
- knowledge of the bird's conservation status, current distribution, life history and taxonomic status is significantly increased;
- at least one pair of Coxen's fig-parrot founders is established and breeding in captivity;
- existing habitat is mapped and conserved, and at least two priority areas of degraded habitat are rehabilitated; and
- active community participation in Coxen's fig-parrot recovery is achieved.

10 Recovery actions

The costs associated with implementing the various actions detailed in this recovery plan are provided in Appendix 2. Parties involved in implementing the actions are indicated in section 11 (Implementation schedule).

10.1 Implement an ecological assessment and monitoring strategy

The current population size, distribution and ecology of Coxen's fig-parrot are poorly known and based largely on supposition. Low impact surveys and, where appropriate, assessment and monitoring of wild populations are required.

10.1.1 Establish survey protocol

All surveys, assessment or monitoring undertaken by government authorities, recovery team members, consultants, other stakeholders and volunteers will, as far as practical, minimise disturbance or disruption to the behaviour of any individuals of any wild populations. These surveys will be in accordance with the Coxen's fig-parrot Survey Protocol. This protocol will be established by the recovery team and will address issues such as confidentiality and credentials of survey participants. The recovery team will maintain a register of all people participating in the survey.

Outcome

A protocol will be developed that minimises interference or disturbance to wild populations of Coxen's fig-parrot resulting from any assessment and monitoring activities undertaken.

10.1.2 Conduct nest site surveys

Nest site surveys will be undertaken intermittently during the non-breeding season (January-July) to identify areas with evidence of recent nesting activity to be targeted during the subsequent breeding season (August-December). These surveys will focus primarily on locations of confirmed records, preferred habitats at localities of recent, credible incidental sightings or localities judged to be potentially important based on knowledge of the bird's distribution. Areas throughout the subspecies' documented and suspected range will be examined. Investigation of the locations of incidental sightings will generate additional information with which to assess records (see 10.1.6) and may yield evidence of nesting in unexpected areas.

Trained and highly experienced personnel will conduct surveys during the non-breeding season. Surveys during the breeding season will be more intensive and, particularly during August and September, will involve searches of the most probable nesting localities. These surveys have advantages, listed in the following outcomes, over the standard survey technique of scanning potential feeding trees or traversing areas of likely habitat in an attempt to observe the birds themselves (e.g. Martindale 1986, Holmes 1990, 1994a, 1995).

Coxen's fig-parrot is thought to nest in the same manner as the red-browed fig-parrot. Training in north Queensland will be undertaken to hone the skills necessary for locating the nest holes of Coxen's fig-parrot. This exercise will enhance observers' abilities in nest recognition, particularly with respect to the height, aspect, positioning and appearance of nest holes, the tree species favoured for nesting and the preferred breeding habitats. In addition, familiarity will be increased with the appearance, flight style, behaviour and calls of the similar red-browed fig-parrot. The training exercise in north Queensland should be conducted by members of the recovery team in October or November so that the experience gained can be passed on to others and applied as soon as possible to ongoing searches for past and current nests of Coxen's fig-parrots.

Dependent upon the success of the Coxen's fig-parrot nest searches, the red-browed fig-parrot nest survey may need to be repeated in other years to provide a refresher course or

training for other members of the recovery team. Close co-operation will be required between New South Wales and Queensland authorities to co-ordinate these studies.

Outcome
Nest site surveys and training will:

- increase the survey skills of participants;
- indicate the existence of fig-parrots in an area regardless of whether birds are actually present at the time of the search;
- indicate localities which are currently occupied or have recently been occupied, and suggest localities which have not;
- indicate likely core areas of a pair's home range, thus providing valuable ecological data; and
- result in the discovery of an active nest, an essential step in the recovery of the subspecies.

10.1.3 Conduct food tree surveys

Fruiting figs will be monitored at known or suspected Coxen's fig-parrot localities. Individual fig trees that either have a history of Coxen's fig-parrot visitation (traditional food trees) or that have abundant fruit at the time of the survey will be monitored. A program of regular volunteer surveys will be mounted using teams of people, trained and supervised, and deployed at multiple food trees or other observation posts throughout one locality. Ideally, two teams, each of two observers, will be allocated alternately per tree. At some sites, the location and identity of all canopy level figs has been determined previously (Horton 1996). Surveys will have a minimum duration of five days and it is expected that searches will be conducted every year during the life of this plan. Localities will be targeted from both southeast Queensland and northeast New South Wales and will include areas in which recent sightings have been made.

Assessment and monitoring programs will be implemented in accordance with this plan at all localities where Coxen's fig-parrots are recorded.

Outcome
The aims of community involvement in future Coxen's fig-parrot surveys are to confirm the presence of birds, to gather details on morphology and calls and to provide vital ecological data. The results may also highlight additional areas to be examined for evidence of nesting activity. Where appropriate, survey outcomes will be published to provide feedback to the community and to encourage further participation in these programs.

10.1.4 Analyse potential predators' prey remains

Prey items discarded by forest-dwelling raptors may be caught by a shade cloth screen (approximately 6m square) suspended above the forest floor beneath a raptor's nest. Forested areas close to past sightings, probable nest sites or core habitat will be targeted in this way.

Regular monitoring of the screens will be undertaken as part of third-year student projects incorporating an investigation of the ecology and dietary preferences of birds of prey. Targeted raptor species will include the brown goshawk *Accipiter fasciatus,* grey goshawk *A. novaehollandiae* and collared sparrowhawk *A. cirrocephalus*.

Outcome
Analysis of prey remains may yield information about the diversity, abundance and seasonality of many prey species taken within an area. These results may indicate the occurrence of fig-parrots at a site regardless of whether birds were actually present at the time of the search.

10.1.5 Use decoy birds

Northern fig-parrot subspecies investigate the source of mimic calls by approaching closely (Hunter in Bourke and Austin 1947, Forshaw 1981). Coxen's fig-parrot may do the same. Caged decoy red-browed fig-parrots will be deployed in the forest canopy in north Queensland to confirm this. If successful, the technique will be adopted at high priority sites for Coxen's fig-parrot during the spring and summer breeding season. The cages will be monitored by remote recording equipment and visited periodically by survey participants. A suitably qualified person must be on site at all times to ensure the well-being of the decoy birds.

Outcome

Wild populations of Coxen's fig-parrot may be located at priority sites.

10.1.6 Operate a formal records appraisal system

The paucity of reported sightings of Coxen's fig-parrots, the potential importance of each sighting for advancing the recovery of the subspecies and the prospect of misidentification by observers, necessitate the adoption of a formal records appraisal process.

A Records Appraisal Committee has been established which consists of six members of the recovery team and people closely affiliated with the team. It has representation from QPWS, NSW NPWS, the Australian Museum and Southern Cross University. Past and current sighting reports (the latter using the existing 'Sighting Report Form' – Appendix 3) will be circulated.

Outcome

The appraisal process will assist field survey work and distribution modeling studies. Operational guidelines for the Records Appraisal Committee will ensure consistency.

10.1.7 Collect ecological data at known Coxen's fig-parrot sites

The habitat at the locations of all Coxen's fig-parrot sightings or nests has not been described fully. Ecological data such as altitude, aspect, disturbance history, forest type and structure, structural dominants, soil type, and presence and abundance of food trees are required. Identification of habitat types and food species used in the cooler months is of special importance for management because of the possible dependence of Coxen's fig-parrot on the now severely depleted lowland forests during a suspected critical winter period (Holmes 1994a, 1995).

Outcome

Characterisation of known Coxen's fig-parrot sites will enhance our knowledge of the bird's habitat requirements and enable improved predictive modeling.

10.1.8 Develop and maintain a records database

A database of all past records of Coxen's fig-parrot will be created including the most recent records, historical sightings and specimen-based records. Regular maintenance and review of the database by the Records Appraisal Committee will ensure it remains current.

Outcome

The database will facilitate the analysis of ecological data, for example highlighting food resources commonly used by the fig-parrots, and will assist in identifying areas for rehabilitation. The database may also reveal over time other high priority areas for survey by identifying geographical, seasonal, altitudinal and/or habitat-associated patterns of the bird's occurrence.

10.1.9 Undertake predictive modeling of distribution

Predictive modeling of the distribution of Coxen's fig-parrot may contribute to recovery by refining current understanding of the subspecies' range and indicating possible field survey targets. The results of a BIOCLIM analysis conducted by the Centre for Research and Environmental Studies at the Australian National University (Holmes 1990) suggested that both the absolute and potential distribution of Coxen's fig-parrot were broader than hitherto documented.

These predictions were subsequently supported by credible sighting reports north and south of the previously recognised distribution limits of the subspecies (Holmes 1994a, 1995, Gynther *et al*. 1998, I. Gynther pers. comm., J. Young pers. comm.). Further modeling work will be conducted which incorporates all credible recent records and relevant ecological data.

Outcome

Modeling will identify areas on which to focus search effort and to include in revegetation and habitat rehabilitation projects.

10.1.10 Implement an ecological monitoring strategy at occupied sites

The ecology of Coxen's fig-parrot is poorly understood. An ecological monitoring strategy will be developed for immediate implementation in the event that a location is discovered where birds can be found repeatedly, e.g. a feeding site or an active nest site. Techniques to be implemented will include direct observation, non-intrusive photography and call recording. Population counts and registers of activity will be kept, and information on diet, breeding biology and behaviour will be gathered. The data may indicate food resources and habitat that is critical for the bird's survival.

Outcome

Implementation of this strategy will ensure a rapid increase in our knowledge of the bird's ecology that will benefit many other facets of the recovery program.

10.1.11 Clarify taxonomic status

Investigation of the taxonomic status and relationships of Coxen's fig-parrot will be undertaken by an analysis of feather samples collected from the three fig-parrot taxa currently recognised in Australia. Wild caught individuals will be used by preference but should these not be available in the case of *C. d. coxeni*, museum specimens will be used. The genetic analysis will be conducted at Southern Cross University under a proposal developed by NSW NPWS and QPWS.

Outcome

Confirmation that Coxen's fig-parrot warrants elevation above the subspecies level might influence funding agencies and potential sponsors to provide financial support for research and management, and would significantly raise public awareness and stimulate search efforts by the ornithological community.

10.1.12 Investigate wild red-browed fig-parrots

A field study of the red-browed fig-parrot will be undertaken to examine life history details of direct relevance to Coxen's fig-parrot. The study is to include dietary preference, activity patterns, flock size, movement patterns and communal roosting behaviour, expanding the similar study begun by Holmes (1995). An important aspect will be the identification of species or genera of north Queensland food plants to assist in determining likely important food resources for Coxen's fig-parrot in southeast Queensland and northeast New South Wales.

Outcome

Studying the red-browed fig-parrot may assist in understanding the ecology and behaviour of the Coxen's fig-parrot and, in so doing, assist in refining the ongoing search effort.

10.1.13 Conduct remote surveys

Surveys using elevated, remotely-activated equipment such as a sound recorder, video recorder or camera may be a cost and time-effective method of monitoring a probable or confirmed nest site and/or confirmed feeding station. The advantages over ground survey are that previously unseen canopy sectors may be monitored and that the method is low impact.

Outcome

The presence of Coxen's fig-parrot may be confirmed and valuable information on appearance, behavioural traits and reproductive biology gathered.

10.1.14 Conduct a literature search

An international literature search for information on comparable situations of severe and/or unexplained avian decline will be instigated using traditional and contemporary methods such as the Internet and Zoological Record.

Outcome

All relevant information and techniques will be available for consideration. Knowledge gained may have ramifications for the design and implementation of strategies for ecological assessment and monitoring, raising community awareness and enhancing habitat quality and extent.

10.2 Undertake captive breeding and release

Captive breeding can allow natural breeding systems to operate in the absence of an identified threat so that stock may be released to the wild, thereby reducing the chance of extinction of a species. Martindale (1986), Garnett (1992), Davidson (1993) and Holmes (1995) have all advocated that a principal recovery plan objective should be to re-establish Coxen's fig-parrot in parts of its former range from which it has disappeared.

Current best practice for the captive breeding and release of parrots (Snyder *et al*. 2000) can be divided into four main steps as follows:

- research and development of approved protocols in advance;
- adequate practice and field-trialing of techniques on analogue taxa;
- implementation of the program on the target species following receipt of relevant approvals; and
- release and assimilation of individuals into the wild, and adoption of termination criteria.

While the latter steps are dependent on locating an active Coxen's fig-parrot nest and may not occur during the life of this Plan, it is important that acquisition, husbandry and release techniques are fully researched, field-trialed using appropriate analogues, approved and funded beforehand. These aspects are discussed further below and are costed in Appendix 2.

Full implementation of a captive breeding program to the point that birds are released into the wild requires detailed justification, careful consideration of the program's cost effectiveness and a clear idea of performance criteria which, if not met, will bring about termination of the program. A summary of these issues is also provided below, but a more complete assessment of current best practice needs to be conducted following a comprehensive literature review.

10.2.1 Develop a Captive Breeding Protocol

A Captive Breeding Protocol for Coxen's fig-parrot will be developed that includes:

- a proposal consisting of a literature review of contemporary parrot captive breeding practices and a justification for captive breeding of Coxen's fig-parrot;
- an action plan that details the initial response, acquisition and transport techniques to be used when obtaining founder stock and which contains all necessary approvals;
- a husbandry manual that describes emergency hand-rearing and fostering techniques and long term captive management practices, as well as identifying areas for further research; and
- a release plan that addresses the strategy and methods for assimilating captive-bred birds into the wild.

The protocol will be submitted to relevant authorities for approval prior to commencing any actions involving Coxen's fig-parrot.

Outcome

All available information and techniques have been considered and the most effective adopted. Captive breeding techniques will be detailed in an established Protocol. Relevant approvals for the Protocol will be in place beforehand in the event that any Coxen's fig-parrot eggs or chicks become available opportunistically or a decision is made to acquire birds from the wild.

10.2.2 Conduct analogue trials

10.2.2.1 Refine capture and transport techniques

Specialist techniques are required to acquire eggs and/or chicks for captive breeding. The proposed techniques outlined in the action plan component of the Captive Breeding Protocol (see action 10.2.1) will be field-trialed on analogues, such as red-browed fig-parrots and lorikeets, and refined as necessary. Improvements to procedures will be documented through modification of the protocol. Training in tree climbing and egg/chick handling at the nest will be required, as will clear and simple procedures for transport that minimise risk to the eggs or young and reduce travel time. Necessary equipment must be purchased. Appropriate contact lists must be prepared and relevant approvals held.

Outcome

A response team will be trained and proficient in all acquisition and transport procedures as detailed in the action plan. A kit containing all relevant equipment, contact lists and approvals will be available on permanent standby.

10.2.2.2 Refine husbandry techniques

Husbandry techniques for the related red-browed fig-parrot have undergone extensive development at Currumbin Wildlife Sanctuary since 1987 (Romer and Spittall 1994). Further research is necessary, particularly with respect to seasonal change in diet, identification and elimination of disease, emergency hand-rearing, cross-fostering and the use of genetic technology to increase reproductive output and diversity of gene pools (Cusack 1997). All procedural refinements which result will be incorporated into the husbandry manual, prepared as a component of the captive breeding protocol (see 10.2.1), so that this document represents the current state of knowledge with regard to maintenance of the analogue population.

Outcome

Prior to a situation arising where Coxen's fig-parrot can be or must be acquired from the wild, there will be established, within the bird's known range, a facility which has the requisite expertise in the captive management of fig-parrots. The husbandry manual will be continually revised to provide up to date and clear guidance for the captive breeding program.

10.2.2.3 Maintain analogue population
The analogue population of red-browed fig-parrots will require ongoing maintenance and husbandry until the results of further research as identified by Cusack (1997) are available for incorporation into the husbandry manual. Adult red-browed fig-parrots may also be needed to act as foster parents should eggs or chicks of Coxen's fig-parrot become available at short notice or when a decision to commence captive breeding is made.

Outcome
Through adherence to procedures in the husbandry manual for both day-to-day and long term captive management, the analogue population of red-browed fig-parrots will be maintained at levels to permit continued research and adequate numbers of foster parents.

10.2.2.4 Release captive-bred analogues
The release of captive-bred Coxen's fig-parrots into the wild is the long-term aim of the captive breeding program. The existence of excess red-browed fig-parrots resulting from the development of husbandry techniques provides an invaluable opportunity to trial release techniques in the field. These include the use of radio transmitters to investigate the success with which birds of captive origin assimilate into wild populations and habitat.

Outcome
Release techniques will have been developed in a timely manner so that the success of any releases of Coxen's fig-parrot in the long term will be greatly increased.

10.2.3 Upgrade facilities for Coxen's fig-parrot
10.2.3.1 Construct aviaries
Commencement of a captive breeding program for Coxen's fig-parrot may necessitate, over time, the construction of additional aviaries to provide adequate disease isolation, space for breeding and sufficient area to allow re-establishment of natural behavioural traits. It may also be advisable to duplicate facilities at other holding institutions as a precautionary measure against disease, theft of birds, fire and other undesirable stochastic events.

Outcome
Adequate infrastructure will be provided in a timely manner as the captive breeding program proceeds to allow smooth expansion of the program and ensure maintenance of the health and normal behaviour of captive-bred birds.

10.2.3.2 Establish security
Red-browed fig-parrots are kept in limited numbers by aviculturists under licence in both New South Wales and Queensland. These birds are difficult to rear and are highly attractive to collectors. They consequently fetch high prices, upwards of $5,000, when traded as adults (J. Hardy, Co-ordinator, NSW NPWS Wildlife Licencing Unit, pers. comm.). Trade in fledglings and eggs is illegal.

As there are no Coxen's fig-parrots held legally under licence in either Australia or overseas, collection from the wild is the only way that this bird could enter into aviculture. Based on the known price of the closely related red-browed subspecies, and given that any individuals would have to be obtained illegally, the potential value of a Coxen's fig-parrot adult could be as high as $30,000 in Australia and higher overseas. The value of eggs is not as great due to the potential for failure in hatching. Nevertheless, it is still likely to be substantial because eggs are far easier to smuggle out of the country.

The potential reward for the illegal collection of birds or eggs from a nest in the wild or from aviary theft means that it is essential that security should be adequate at these sites. Any holding institution involved in the program shall undertake a review of security and implement

comprehensive measures necessary to protect the captive birds. These measures will be detailed in the captive breeding protocol (see action 10.2.1).

Outcome
Appropriate security measures will be in place to secure the analogue birds and any Coxen's fig-parrots that may be acquired or bred.

10.2.4 Initiate program for Coxen's fig-parrot

Implementation of a captive breeding program for Coxen's fig-parrot is dependent upon completing the captive breeding protocol (see action 10.2.1), securing adequate funding, obtaining approvals and licences to proceed from state authorities and ethics committees, and locating an active nest from which founder stock can be sourced. Once these conditions are met, the recovery team will consider initiating a program which incorporates the following:

- acquisition and transport of founder stock to the holding facility;
- security of the nest from which founder stock is sourced;
- ongoing monitoring of the nest; and
- maintenance of the captive population.

These elements of the program will be discussed in detail in the action plan and husbandry manual which are to form components of the captive breeding protocol.

10.2.4.1 Acquire founder stock

Founder stock will be acquired and transported to the holding facility using techniques and procedures previously practised on appropriate analogues and the equipment kit previously prepared and held by the holding institution (see 10.2.2.1). Trained members of a response team, as nominated in the action plan, will be bound by a confidentiality agreement. All relevant approvals are to be in place, including permission from any relevant private landowners, before founder stock is acquired.

Outcome
Founder stock will be successfully acquired and safely transported to the holding facility with a minimum of administrative or logistical delay.

10.2.4.2 Ensure security of nest

The potential for any nest found in the wild to be disturbed, either unintentionally by members of the public or deliberately as a result of a breach of confidentiality, will need to be carefully assessed. In addition to losses through poaching, undue disturbance can result in nest desertion by the parent birds and negate opportunities for either re-clutching later that season or reusing the nest tree in future breeding seasons. Where security is considered necessary, options for action may include the use trained volunteers, professional security officers, state conservation agency staff or a rostered combination of the above. Breaches of security will be reported to relevant law enforcement agencies.

Outcome
All active Coxen's fig-parrot nest locations will be protected from disturbance for the duration of the current and subsequent breeding seasons.

10.2.4.3 Monitor nest after acquisition of eggs or chicks

The recovery team will recommend to the relevant agency the appointment of a qualified person from a previously prepared shortlist to monitor the nest and the breeding adult pair after eggs or chicks have been removed from the nest chamber for the purposes of captive breeding. Among others, the following questions will be investigated during the monitoring program:

- What are the behavioural and reproductive responses of the parent birds to the nest robbing?
- Do these responses accord with those of red-browed fig-parrots, both in the wild and in aviaries?
- Is the nest abandoned in favour of another pre-existing one or is a new nest excavated?
- What is the delay until any re-clutching occurs and what behaviour is involved?

Consideration will also be given to attaching radio transmitters to the parents so that, in addition to gaining information on home range sizes and the possible location of other birds in the general vicinity, the adult pair can be located in the event of nest desertion. These benefits of a radiotelemetry study will be weighed carefully against the potential hindrance to re-clutching at the same nest.

Depending on the nest location, monitoring may be expected to require the researcher to spend considerable periods of time elevated in the canopy. It may also need to be repeated in subsequent breeding seasons if the nest remains active. Where circumstances allow, monitoring efforts may be combined with any security program (see action 10.2.4.2).

Outcome
The impact of egg/chick acquisition on the parent birds will be assessed and information gained on breeding biology and the potential for the nest to be used for future acquisitions.

10.2.4.4 Ensure successful husbandry of captive population
Once founding stock has been acquired and transported to the holding facility, it will be maintained and bred in captivity in accordance with the husbandry manual. This will require annual funding for the duration of the program in accordance with estimates provided by the holding facility and subject to agreement with the relevant state government. The funds will be supplemented by community and commercial sponsorship. The duration of the program will depend upon breeding success rates and assessment of the number of birds needed to found one or more wild population. Details of funding estimates and performance criteria will be provided in the captive breeding protocol (see action 10.2.1).

Outcome
The captive population will be successfully maintained and augmented by the holding institution over an agreed timeframe. Operation of the captive breeding program will be based upon predetermined performance criteria.

10.2.5 Construct facilities for release of captive-bred Coxen's fig-parrots
The release of captive-bred Coxen's fig-parrots back into the wild will not occur during the period covered by this recovery plan. Nevertheless, consideration of the issues involved will be necessary since they are pertinent to obtaining initial approvals to proceed with the captive breeding program. These issues will be addressed in the Captive Breeding Protocol (see 10.2.1) following a review of best practice in relation to successful parrot release programs elsewhere around the world.

The funding required and its timing will be dependent on the success of the captive breeding program in raising birds for release and the success of other elements of the recovery plan in identifying and ameliorating threatening processes in the wild. At the very least, funding will need to be secured for the construction of an *in situ* holding facility at an appropriate location to allow the birds to become acclimatised to the release site and establish adaptive behavioural traits. The "soft release" facility would also provide an opportunity to monitor released birds during their assimilation into the wild.

Outcome

A program and facilities for release of Coxen's fig-parrot will be in place by the time captive-bred birds are ready for release and threatening processes in the wild are ameliorated.

10.3 Assess Coxen's fig-parrot habitat

A thorough assessment of the quantity, distribution and spatial arrangement of remnant rainforest and other habitat, and of the distribution, abundance and fruiting schedules of known fig-parrot food species is crucial for the development of an effective revegetation and rehabilitation strategy. A detailed map of fig tree distribution will also establish priority areas for revegetation.

10.3.1 Map the distribution of suitable habitat in the Coxen's fig-parrot's range

Detailed, accurate and up-to-date mapping of the distribution of rainforest and other suitable habitat in south-east Queensland and north-east New South Wales would assist the recovery program for Coxen's fig-parrot, particularly in targeting areas for revegetation or rehabilitation and in identifying potential corridors. Its greatest application would be in the lowlands where the majority of remnant fig-parrot habitat is unprotected.

The entire suspected distribution of Coxen's fig-parrot should be mapped with particular emphasis placed on areas within a 30km radius of recent documented sightings of the bird, remnant figs and rainforests, and those areas which link confirmed Coxen's fig-parrot localities. This mapping will be based initially upon aerial photographic analysis such as that used by NSW NPWS as part of the Comprehensive Regional Assessment. It be will refined by ground-truthing in priority locations, e.g. around known locations of Coxen's fig-parrot, and in areas proposed for habitat rehabilitation and/or the development of wildlife corridors. Remote sensing, such as satellite and/or aerial digital multispectral video imaging, will be trialed and developed to assist in the mapping of actual and potential habitat, particularly fig trees. Other developments in mapping technology should be incorporated as they become available.

Outcome

Mapping will facilitate the development of a revegetation and rehabilitation strategy and will assist with the assessment of sightings. A detailed map of fig tree distribution and density will be produced to establish high priority areas for revegetation projects.

10.3.2 Investigate Coxen's fig-parrot food plants

Coxen's fig-parrot may be threatened by the occurrence of inadequate or discontinuous food resources, possibly on a seasonal basis. The ecology of Coxen's fig-parrot food resources is poorly understood. In particular, factors triggering the fruiting patterns of fig species have been little researched. Furthermore, the role of fig-pollinating wasps in determining the nutritional quality of fig fruit is unknown but may be of critical importance. Previous studies (Storey 1994, Horton 1996) have been of limited time and scope.

A three year university project will be initiated to investigate the distribution and phenology of known and probable food plants of Coxen's fig-parrot. Knowledge of red-browed fig-parrot food plants will be incorporated where relevant.

Outcome

The information gleaned will contribute greatly to our understanding of the ecology of Coxen's fig-parrot and assist in determining suspected threats to the bird's continued survival.

10.4 Protect and enhance Coxen's fig-parrot habitat

Based on information gathered from tasks described under 10.1 and 10.3, a program to protect known habitat, rehabilitate degraded habitat and revegetate former habitat of Coxen's fig-parrot will be undertaken.

10.4.1 Develop management prescriptions and protocols for logging identified Coxen's fig-parrot habitat

Much of the bird's remaining habitat occurs in state forests and, at least in the locations described by Norris (1964), Holmes (1994a, 1995) and J. Young (pers. comm.), logging adjacent to rainforest may have affected the bird's habitat. Probable fig-parrot nests have been observed as early as July in mature flooded gum *Eucalyptus grandis* near the rainforest edge and in areas with a rainforest understorey (J. Young pers. comm.).

Threatened Species Licence conditions in the NSW Integrated Forestry Operations Approval (IFOA) require SF NSW and NSW NPWS to jointly develop and agree on site-specific conditions for all records in state forest that may be affected by logging operations. Such operations must not commence until these conditions are in place.

Conditions relating to proposed logging near rainforest in state forests north of the Bruxner Highway in NSW are currently being developed but extension of management guidelines to include all probable habitat in state forests within the bird's range is required. Rainforest edge buffers currently approved under the IFOA may require amendment in the vicinity of known fig-parrot habitat. These buffers should be protected from controlled burns during the August-December breeding season.

At lower elevations, such as in the SF NSW Murwillumbah Management Area, CSIRO (1996) concluded that management that allows rainforest to regenerate to subtropical rainforest will maintain or enhance Coxen's fig-parrot numbers. Such practices should be included in general forest management guidelines, but the potential impact on other threatened species which may use the forest ecotone, e.g. eastern bristlebird *Dasyornis brachypterus*, must be carefully considered. Initial prescriptions will be updated as more ecological data on Coxen's fig-parrot become available.

Outcome

Existing habitat within state forests will be protected.

10.4.2 Regulate land use by state and local authorities

Various regulatory avenues are available to protect and enhance known and probable Coxen's fig-parrot habitat and these can be used in co-operation with extension activities for land managers and private landholders.

Regulatory avenues include:

- Identification by local government and/or appropriate state agencies of known or probable Coxen's fig-parrot habitat in relevant planning schemes, e.g. State environmental protection policies, strategic plans, development control plans and local or regional environment plans. These schemes include community consultation by way of seminars and public exhibition of documents, and the production of guidelines outlining how the habitat may be managed effectively for conservation.

- Preparation of property management plans by private landowners or, as a last resort, the issuing of Stop Work Orders by NSW NPWS under the *Threatened Species Conservation Act 1995*.

- Creation and implementation of Vegetation Protection Orders or Tree Preservation Orders by local governments to protect identified and possibly isolated food trees that may form essential foraging habitat for Coxen's fig-parrot.

- Use of appropriate development consent conditions to encourage food tree planting.

- Restrictions on the clearing of native vegetation.

- Creation of Interim or Permanent Conservation Orders under relevant legislation.

The above measures can be used in conjunction with voluntary approaches to achieve conservation of important habitats on lands outside existing reserves. Voluntary approaches include the creation of Voluntary Conservation Agreements. For example, in Queensland, security of tenure can be achieved through Nature Refuge agreements under the *Nature Conservation Act 1992*. Also, covenants with the state, local government or statutory body can be registered to titles of properties to protect environmental values. These covenants are then binding for all successors in title. Property planning extension work including programs such as Land for Wildlife may also offer effective means of ensuring landholders preserve key habitats.

Outcome
Known or probable Coxen's fig-parrot habitat outside conservation reserves will be better protected.

10.4.3 Rehabilitate habitat

Restoration of degraded habitats to form healthy viable ecosystems is the primary objective of rainforest rehabilitation. Restoration includes staged weeding and replanting programs to achieve a self-perpetuating ecosystem that is maintenance free. Liaison with relevant rainforest recovery teams and community groups such as Landcare, Bushcare and Greening Australia is recommended to facilitate selection of methods and species, and to co-ordinate with other rainforest restoration projects.

Spatial continuity and diversity of probable food resources need to be enhanced by expanding the area of suitable habitat and by providing interconnecting habitat corridors, especially along watercourses. Lowland rainforest areas and potential forest links are a priority, especially in localities where Coxen’s fig-parrot is currently known or suspected to occur.

Outcome
A major threatening process will be ameliorated by increasing the availability of healthy, viable habitat for Coxen's fig-parrot and other threatened species.

10.4.4 Initiate propagation of food trees

Large scale propagation of known and presumed Coxen’s fig-parrot food trees will be initiated. Seed collectives and commercial seed collectors should be contacted to commence collection of the appropriate species. The propagation program should take advantage of established infrastructure as offered by SF NSW, Greening Australia, Landcare, Currumbin Wildlife Sanctuary, shire council nurseries and other contract rainforest tubestock growers.

Coxen's fig-parrot food plant kits will be distributed. These will contain seedlings of known and probable Coxen's fig-parrot food trees including certain fleshy-fruited rainforest trees, the larger fig species (*Ficus macrophylla, F. watkinsiana* and *F. obliqua*) and the smaller, fast growing and fast fruiting sandpaper figs (*F. opposita, F. fraseri* and *F. coronata*). Other species besides figs should also be considered to get a mix of species across the landscape. The kits should include local species from appropriate genetic stock with the goal of providing a seasonal spread of fruit availability.

The mixed species kits or individual specimens of food trees will be:

- available for resale from key tourism outlets including NSW NPWS offices, travel information centres, SF NSW sales outlets, ecology and ecotourism centres and other targeted outlets;
- included in local government “free trees and shrubs” for ratepayers;
- planted as street trees (where potential damage to roadways caused by roots can be avoided) and/or in open space and local reserves;
- incorporated in roadside rehabilitation schemes;
- incorporated into SF NSW Joint Venture Schemes;
- included as Greening Australia’s stock for Trees on Farms and other private agricultural plantings;
- available to schools for gardens and school projects; and
- recommended and supplied as preferred plants for use by Landcare, catchment management and rehabilitation groups.

Outcome
The program will raise community awareness, expand Coxen's fig-parrot habitat and create additional food resources in urban and rural settings.

10.4.5 Contact New South Wales Nurseryman’s Association
Negotiations will be made with the New South Wales Nurseryman’s Association for production of “I’m a Coxen's fig-parrot food tree” labels for inclusion on commercial nursery stock and all trees produced under action 10.4.4.

Outcome
Community awareness and bird food resources will be increased through stronger encouragement and promotion of the planting of food trees.

10.5 Implement a community awareness strategy
The support and active participation of the community are crucial to the success of the Coxen’s fig-parrot recovery program, with community members being responsible for undertaking many important tasks in the present recovery plan. However, successful implementation of the entire plan necessitates effectively communicating the required actions not just to the general public, but more broadly, to include government agencies, forestry and farming industries, researchers, funding bodies, special interest groups, and other target organisations. A good public education and information program provides a means of involving all participants in the recovery process and is, therefore, a vital component in the overall plan.

The objective of the strategy is to raise community awareness of Coxen's fig-parrot and its plight to the extent that the community “adopts” Coxen's fig-parrot, develops independent skills to reliably locate, identify and report sightings of the bird and, importantly, becomes proactive in the conservation and rehabilitation of its habitat.

The effectiveness of informal community surveys by an informed public has been demonstrated by the number of highly plausible fig-parrot sightings reported in the greater Bundaberg area following a publicity campaign associated with the community-based survey there in 1998. Informal community surveys exponentially expand survey effort in both spatial and temporal dimensions and have been shown to be very cost-effective.

10.5.1 Develop and maintain a community network
Development of a community network for the conservation of Coxen’s fig-parrot and its habitat will be achieved most effectively through existing projects and established conservation groups. A community network may assist with targeted field surveys, reporting incidental sightings and participating in projects to re-establish fig-parrot habitat. Possible

network links include Birds Australia's Threatened Bird Network Co-ordinator, the Threatened Species Network, the Endangered Rainforest Plants Recovery Team, Greening Australia, SF NSW Joint Venture Program, bushwalking and birdwatching clubs and Landcare coordinators. Information about the community network will be databased. This network will be developed in accordance with the Community Network Strategy devised by the Threatened Species Network.

Outcome
Increased community awareness and ownership of the recovery of Coxen's fig-parrot will be achieved, thereby promoting greater public participation in the recovery program.

10.5.2 Establish a community participation and publicity campaign

A targeted publicity campaign similar to the Richmond River birdwing butterfly campaign is an efficient method of engaging community participation. A selection of preliminary campaign thrusts include:

- establishing community response teams composed of experienced ornithologists who can respond immediately to reports of opportunistic sightings;
- utilisation of existing networks to enlist volunteers for surveys and rehabilitation works;
- an identification incentive in the form of a sponsored reward for a confirmed record of Coxen's fig-parrot;
- inclusion of a publicity strategy for Coxen's fig-parrot as an assignment at local universities;
- preparation of publicity material such as T-shirts, posters, traveling display boards (for shopping centres etc.), food-plant kits, brochures, and fridge magnets for resale;
- production of flyers for inclusion with local government rates notices;
- working with local government to promote and develop 'plant figs in public places' schemes;
- offering incentives to schools to conduct projects and artwork in relation to Coxen's fig-parrot;
- conducting media interviews about Coxen's fig-parrot and requesting volunteers for surveys and rehabilitation works;
- placement of regular articles in popular magazines and daily media;
- production of a regular newsletter for circulation to the community network and more widely; and
- production of a video on research/survey to date for screening at seminars and public talks.

Outcome
The campaign will raise community awareness and lead to increased opportunities for wild populations of Coxen's fig-parrot to be located. A coincidental reduction in opportunities to deal illegally in Coxen's fig-parrot will result.

10.6 Manage the recovery process

10.6.1 Co-ordinate the recovery program

A part-time co-ordinator will oversee implementation of all aspects of this plan, including liaison with appropriate government agencies, non-government organisations, the forest industry, farming organisations, academic institutions, natural history clubs and societies, Landcare and catchment management groups, and the general public. The co-ordinator will carry out many of the actions in this plan and facilitate the implementation of others. The person will, therefore, not only be responsible for overall co-ordination of the recovery process, but will play a critical role in implementing those actions most directly associated with the core strategies of this plan, namely the shaping of community-based programs to

help conserve the Coxen's fig-parrot and the co-ordination of public education. The co-ordinator will report directly to the recovery team.

Meetings of the recovery team will be held at least annually, and more frequently if required. The team, in conjunction with the part-time co-ordinator, will review the progress of the recovery program on an ongoing basis.

Outcome
Recovery actions will be well co-ordinated and targeted, thereby maximising their effectiveness.

11 Implementation schedule

The schedule (Table 2) indicates which government agencies and other relevant parties are involved in implementing the recovery actions specified in this plan. The actions are costed separately in Appendix 2. In this schedule, priority is categorised as 1 (essential), 2 (highly desirable) or 3 (desirable). Adherence to priorities will depend on the obtaining adequate funding.

Feasibility is an estimate of the chance of each action achieving its intended outcome given the funding identified in this recovery plan. A realistic assessment of feasibility is difficult for this taxon given its rarity and the difficulty associated with obtaining consistent and timely records. It should also be noted that many tasks are interdependent and so the feasibility of one action may hinge upon a successful result being achieved in another. The feasibility values below are presented as a guide and caution should be exercised if using them to determine future funding criteria. Both feasibility values and funding criteria for Coxen's fig-parrot may require substantial review in the event that a stable and discrete population can be reliably located.

Table 2. *Implementation schedule.*

Task No.	Task Description	Priority	Feasibility	Involved in Implementation
10.1	**Ecological assessment and monitoring**			
10.1.1	Survey protocol	2	100%	QPWS, NSW NPWS, SF NSW
10.1.2	Nest surveys	1	40%	QPWS, NSW NPWS
10.1.3	Food tree surveys	1	40%	QPWS, NSW NPWS, Others
10.1.4	Prey remains analysis	3	25%	QPWS, NSW NPWS, University
10.1.5	Decoy bird use	3	25%	QPWS, NSW NPWS, CWS
10.1.6	Records appraisal system	2	100%	QPWS, NSW NPWS, AM, University
10.1.7	Ecological data collection at known sites	1	90%	QPWS, NSW NPWS, SF NSW, University
10.1.8	Records database	2	100%	QPWS, NSW NPWS
10.1.9	Predictive modeling	2	100%	QPWS, NSW NPWS, University
10.1.10	Ecological monitoring at occupied sites	1	80%	QPWS, NSW NPWS, Consultant
10.1.11	Taxonomic investigation	2	90%	QPWS, NSW NPWS, SCU
10.1.12	Red-browed fig-parrot field study	2	100%	QPWS, NSW NPWS, CWS
10.1.13	Remote surveys	2	80%	QPWS, NSW NPWS, SF NSW
10.1.14	Literature search	3	100%	QPWS, NSW NPWS
10.2	**Captive breeding and release**			
10.2.1	Captive breeding protocol	1	100%	QPWS, NSW NPWS, CWS
10.2.2	Analogue trials			
10.2.2.1	Refinement of capture/transport techniques	1	90%	QPWS, NSW NPWS, CWS
10.2.2.2	Husbandry refinement	1	90%	QPWS, NSW NPWS, CWS
10.2.2.3	Maintenance of analogue population	1	100%	CWS
10.2.2.4	Release of captive-bred analogues	3	70%	QPWS, NSW NPWS, CWS
10.2.3	Upgrade of Coxen's fig-parrot facilities			
10.2.3.1	Aviary construction	2	100%	QPWS, NSW NPWS, CWS
10.2.3.2	Establishment of security	1	90%	CWS
10.2.4	Initiation of Coxen's fig-parrot program			
10.2.4.1	Acquisition of founder stock	1	70%	QPWS, NSW NPWS, CWS
10.2.4.2	Nest security	1	80%	QPWS, NSW NPWS, Others
10.2.4.3	Nest monitoring post acquisition	1	90%	QPWS, NSW NPWS, Others
10.2.4.4	Husbandry of captive population	1	80%	QPWS, NSW NPWS, CWS

Task No.	Task Description	Priority	Feasibility	Involved in Implementation
10.2.5	Release facilities for Coxen's fig-parrot	3	50%	QPWS, NSW NPWS, CWS
10.3	**Habitat assessment**			
10.3.1	Habitat distribution mapping	2	90%	QPWS, NSW NPWS, SF NSW, University
10.3.2	Food plant study	2	90%	QPWS, NSW NPWS, University
10.4	**Habitat protection and enhancement**			
10.4.1	Prescriptions and logging protocols	1	100%	QPWS, NSW NPWS, SF NSW, DNR
10.4.2	Land use regulation	1	100%	QPWS, NSW NPWS, DUAP, Local govt.
10.4.3	Habitat rehabilitation	1	100%	QPWS, NSW NPWS, SF NSW, DUAP, DLWC, Local govt., Others
10.4.4	Food tree propagation	1	100%	QPWS, NSW NPWS, SF NSW, Local govt., Others
10.4.5	Nurseryman's Assoc. contact	2	100%	NSW NPWS
10.5	**Community awareness**			
10.5.1	Community network	2	100%	QPWS, NSW NPWS
10.5.2	Publicity campaign	1	100%	QPWS, NSW NPWS, SF NSW, Local govt., CWS, Others
10.6	**Recovery management**			
10.6.1	Co-ordination of recovery program	1	100%	QPWS, NSW NPWS

LEGEND

QPWS	=	Queensland Parks and Wildlife Service
NSW NPWS	=	New South Wales National Parks and Wildlife Service
SF NSW	=	State Forests of New South Wales
DNR	=	Queensland Department of Natural Resources
DUAP	=	New South Wales Department of Urban Affairs and Planning
DLWC	=	New South Wales Department of Land and Water Conservation
CWS	=	Currumbin Wildlife Sanctuary and/or other holding institutions with captive fig-parrots
AM	=	Australian Museum
SCU	=	Southern Cross University
Local govt.	=	Local government areas within the bird's range in both states.
Others	=	Relevant non-government organisations including the Threatened Species Network, Wildlife Preservation Society of Queensland, Bundaberg Branch of the Bird Observers Club of Australia, Save Today Our Parkland, Landcare groups, Greening Australia

12 Preparation details

This recovery plan has been prepared by Ian Gynther, John Martindale and Stephanie Horton in close consultation with other members of the Coxen's Fig-Parrot Recovery Team. The actions, outcomes, priorities and costs are those agreed by the team but do not necessarily represent the views of individual members or consultants.

12.1 Date of last amendment

No amendments have been made to date.

12.2 Review date

This recovery plan will be reviewed within five years of the date of publication.

Acknowledgements

This recovery plan is the culmination of the dedication and work of many people over an extended period of time. Special thanks are due to Ian Gynther and Stephanie Horton for preparing and editing the initial drafts and to John Martindale for his efforts in reshaping these early versions into the New South Wales draft recovery plan upon which the present document is largely based. The following people are also to be thanked for their valuable contributions: David Charley, Sonia Goldie, Wayne Longmore, Bob Moffat, Peter O'Reilly, Liz Romer, Des Spittall, David Stewart and Maria VanderGragt.

This project has only been possible as a result of funding provided by the Commonwealth Government through its Endangered Species Program, administered by the Threatened Species and Communities Section, Biodiversity Group, Environment Australia.

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Appendices

Appendix 1. Recovery team

The Coxen's Fig-Parrot Recovery Team currently includes the following government agencies and organisations and the nominated representatives:

Agency or Organisation	**Individual/s**
• Queensland Parks and Wildlife Service (QPWS)	Ian Gynther
• New South Wales National Parks and Wildlife Service (NSW NPWS)	John Martindale David Charley Bob Moffatt
• State Forests of New South Wales (SF NSW)	Ken McCray
• Museum Victoria	Wayne Longmore
• Currumbin Wildlife Sanctuary	Clancy Hall
• O'Reilly's Rainforest Guesthouse	Tim O'Reilly
• Threatened Species Network (Queensland)	Keryn Hyslop
• Wildlife Preservation Society of Queensland	Anna Greig

The composition of the team is not intended to limit the potential involvement of other individuals or organisations in the recovery process. In addition, people with relevant expertise and experience are invited to attend meetings as observers whenever necessary.

Appendix 2. Cost of recovery plan over five years

Note: Costs associated with some tasks in this recovery plan are dependent upon establishing the occurrence of Coxen's fig-parrots in a particular area or locating birds on a repeatable basis, e.g. at an active nest or feeding site. In such circumstances, the relevant tasks or components of tasks will be undertaken in whichever state this should happen first. The costs shown are based on the assumption that only one such site is found and this discovery occurs during the first year of the plan. Additional discoveries will add to these totals. Should a nest not be found during the life of the recovery plan or approval to commence captive breeding not be forthcoming, actions 10.2.3 - 10.2.5 become irrelevant and the cost and conservation value of the recovery plan are substantially reduced. Most funds are unsecured, although, as indicated, some actions are currently funded in the first year and are already in progress. Costs, where appropriate, include cash and in kind contributions from QPWS, NSW NPWS and other parties involved in implementation. Priority codes are as in Table 2 (Implementation schedule). Costs are shown in $'000s.

Action	Task No.	Task Description	Priority	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
10.1 Ecological assessment and monitoring	10.1.1	Survey protocol	2	1.0	–	–	–	–	1.0
	10.1.2	Nest surveys[1]	1	10.0	10.0	4.0	4.0	2.0	30.0
	10.1.3	Food tree surveys[1]	1	6.0	6.0	4.0	2.0	2.0	20.0
	10.1.4	Prey remains analysis	3	1.0	1.0	–	–	–	2.0
	10.1.5	Decoy bird use	3	1.0	1.0	–	–	–	2.0
	10.1.6	Records appraisal system	2	1.0	1.0	1.0	0.5	0.5	4.0
	10.1.7	Ecological data collection at known sites	1	6.0	6.0	–	–	–	12.0
	10.1.8	Records database	2	2.0	0.5	0.5	0.5	0.5	4.0
	10.1.9	Predictive modeling	2	8.0	–	–	–	–	8.0
	10.1.10	Ecological monitoring at occupied sites[2]	1	20.0	15.0	10.0	5.0	5.0	55.0
	10.1.11	Taxonomic investigation[7]	2	15.0	1.0	1.0	–	–	17.0
	10.1.12	Red-browed fig-parrot field study	2	4.0	2.0	2.0	–	–	8.0
	10.1.13	Remote surveys[2]	2	4.0	4.0	–	–	–	8.0
	10.1.14	Literature search	3	1.0	–	–	–	–	1.0
10.2 Captive breeding and release	10.2.1	Captive breeding protocol	1	6.0	4.0	–	–	–	10.0
	10.2.2	Analogue trials							
	10.2.2.1	Refinement of capture/transport techniques	1	10.0	–	–	–	–	10.0
	10.2.2.2	Husbandry refinement	1	20.0	10.0	5.0	–	–	35.0
	10.2.2.3	Maintenance of analogue popn.	1	6.0	6.0	6.0	6.0	6.0	30.0
	10.2.2.4	Release of captive-bred analogues[4]	3	–	–	–	–	5.0	5.0
	10.2.3	Upgrade of facilities for Coxen's fig-parrot							
	10.2.3.1	Aviary construction[3,5]	2	50.0	20.0	–	–	–	70.0
	10.2.3.2	Establishment of security[3]	1	37.0	10.0	10.0	10.0	10.0	77.0
	10.2.4	Initiation of Coxen's fig-parrot program							
	10.2.4.1	Acquisition of founder stock[3,4]	1	3.0	3.0	3.0	3.0	3.0	15.0
	10.2.4.2	Nest security[3,6]	1	8.0	8.0	8.0	8.0	8.0	40.0
	10.2.4.3	Nest monitoring post-	1	8.0	8.0	8.0	8.0	8.0	40.0

Action	Task No.	Task Description	Priority	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
		acquisition[3,4,6]							
	10.2.4.4	Husbandry of captive popn.[3,4]	1	17.5	14.0	14.0	14.0	14.0	73.5
	10.2.5	Release facilities for Coxen's fig-parrot [3,4]	3	–	–	–	–	5.0	5.0
10.3 Habitat assessment	10.3.1	Habitat distribution mapping[1,7]	2	10.0	10.0	–	–	–	20.0
	10.3.2	Food plant study	2	6.0	6.0	2.0	–	–	14.0
10.4 Habitat protection and enhancement	10.4.1	Prescriptions and logging protocols[8]	1	–	–	–	–	–	0.0
	10.4.2	Land use regulation[8]	1	–	–	–	–	–	0.0
	10.4.3	Habitat rehabilitation[1,7]	1	40.0	20.0	20.0	20.0	20.0	120.0
	10.4.4	Food tree propagation[7]	1	10.0	10.0	4.5	2.0	2.0	28.5
	10.4.5	Nurseryman's Assoc. contact	2	0.5	0.5	–	–	–	1.0
10.5 Community awareness	10.5.1	Community network	2	3.0	3.0	3.0	3.0	3.0	15.0
	10.5.2	Publicity campaign[1]	1	6.0	4.0	4.0	2.0	2.0	18.0
10.6 Recovery management	10.6.1	Co-ordination of recovery program[9]	1	20.0	20.0	20.0	20.0	20.0	100.0

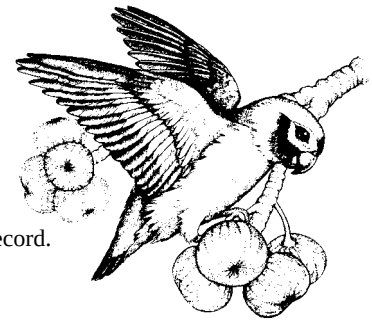
Implementation costs over and above those already secured in Year 1	266.0	204.0	130.0	108.0	116.0	**824.0**

Total costs of implementing recovery plan	341.0	204.0	130.0	108.0	116.0	**899.0**

1. Portions of costs are dependent upon obtaining confirmation that birds occur at a certain locality.
2. Total costs are dependent upon discovery of a site where birds can be monitored.
3. Costs are dependent upon locating an active nest from which founder stock can be sourced.
4. Assumes this action is endorsed by relevant authorities.
5. Assumes existing aviaries at holding institutions are insufficient and allows for duplication of facilities to minimise risk from disease, fire, theft, etc.
6. Assumes wild pair/s continue to breed over five years.
7. Actions are in progress and costs indicated for Year 1 have already been committed or secured.
8. Actions are to be conducted independently of recovery plan and no additional costs are incurred.
9. Part-time position only.

Appendix 3. Coxen's fig-parrot Sighting Report Form

Coxen's Fig-Parrot Recovery Team



Sighting Report Form

Please use this to document details of any Coxen's fig-parrot *Cyclopsitta diophthalma coxeni* record.

Mail to: Qld – Ian Gynther, QPWS, PO Box 42, Kenmore Qld 4069.
NSW – John Martindale, NSW NPWS, Locked Bag 914, Coffs Harbour NSW 2450.

Name:

Address:

Contact phone: (H) (W) (Fax)

Other observers present (include addresses and phone nos):

Date of observation:

Location (be as precise as possible, e.g. include park or state forest name, distance and bearing from named point features, road/track name, latitude/longitude etc.):

Habitat description (e.g. broad vegetation type, dominant tree species, topography, altitude etc.):

Sighting conditions (time of day, weather, visibility, duration of observation):

Optical or other aids used (e.g. binoculars, telescope, tape recorder):

Number of birds observed:

Distance from bird/height of bird above ground:

Prior experience with this species:

How confident are you of your identification? (e.g. 80%, 100%?):

Please turn over

Description of bird (describe what you saw/heard, e.g. size, shape, comparative size of body parts, plumage, colour of eyes and bill, age, sex, calls etc. Attach copies of any sketches or field notes made. Use extra pages if required):

Behaviour of bird (What was the bird doing when observed? What alerted you to its presence?):

How was it distinguished from similar species?:

Reference books used:

Other comments:

[Office Use Only] Received: Case No.: Recommendation: