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CYPLUS
CAPE YORK PENINSULA
LAND USE STRATEGY

NATURAL RESOURCES ANALYSIS PROGRAM
(NRAP)

ECOLOGY AND CONSERVATION OF THE GOLDEN-SHOULDERED PARROT

S.T. Garnett and G.M. Crowley
Queensland Department of Environment and Heritage
1995

CYPLUS is a joint initiative of the Queensland and Commonwealth Governments

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Final report on project:

NR21 - GOLDEN-SHOULDERED PARROT CONSERVATION MANAGEMENT

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Note:

Due to the timing of publication, reports on other CYPLUS projects may not be fully cited in the REFERENCES section. However, they should be able to be located by author, agency or subject.

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CAPE YORK PENINSULA LAND USE STRATEGY
STAGE I

PREFACE TO PROJECT REPORTS

Cape York Peninsula Land Use Strategy (CYPLUS) is an initiative to provide a basis for public participation in planning for the ecologically sustainable development of Cape York Peninsula. It is jointly funded by the Queensland and Commonwealth Governments and is being carried out in three stages:

- Stage I - information gathering;
- Stage II - development of principles, policies and processes; and
- Stage III - implementation and review.

The project dealt with in this report is a part of Stage I of CYPLUS. The main components of Stage I of CYPLUS consist of two data collection programs, the development of a Geographic Information System (GIS) and the establishment of processes for public participation.

The data collection and collation work was conducted within two broad programs, the Natural Resources Analysis Program (NRAP) and the Land Use Program (LUP). The project reported on here forms part of one of these programs.

The objectives of NRAP were to collect and interpret base data on the natural resources of Cape York Peninsula to provide input to:

- evaluation of the potential of those resources for a range of activities related to the use and management of land in line with economic, environmental and social values; and
- formulation of the land use policies, principles and processes of CYPLUS.

Projects examining both physical and biological resources were included in NRAP together with Geographic Information System (GIS) projects. NRAP projects are listed in the following Table.

Physical Resource/GIS Projects	Biological Resource Projects
Bedrock geological data - digitising and integration (NR05)	Vegetation mapping (NR01)
Airborne geophysical survey (NR15)	Marine plant (seagrass/mangrove) distribution (NR06)
Coastal environment geoscience survey (NR14)	Insect fauna survey (NR17)
Mineral resource inventory (NR04)	Fish fauna survey (NR10)
Water resource investigation (groundwater) (NR16)	Terrestrial vertebrate fauna survey (NR03)
Regolith terrain mapping (NR12)	Wetland fauna survey (NR09)

Physical Resource/GIS Projects	Biological Resource Projects
Land resource inventory (NR02)	Flora data and modelling (NR18)
Environmental region analysis (NR11)	Fauna distribution modelling (NR19)
CYPLUS data into NRIC database FINDAR (NR20)	Golden-shouldered parrot conservation management (NR21)
Queensland GIS development and maintenance (NR08)*	
GIS creation/maintenance (NR07)*	

* These projects are accumulating and storing all Stage I data that is submitted in GIS compatible formats.

Research priorities for the LUP were set through the public participation process with the objectives of:

- collecting information on a wide range of social, cultural, economic and environmental issues relevant to Cape York Peninsula; and
- highlighting interactions between people, land (resource use) and nature sectors.

Projects were undertaken within these sector areas and are listed in the following Table.

People Projects	Land Projects	Nature Projects
Population	Current land use	Surface water resources
Transport services and infrastructure	Land tenure	Fire
Values, needs and aspirations	Indigenous management of land and sea	Feral and pest animals
Services and infrastructure	Pastoral industry	Weeds
Economic assessment	Primary industries (non-pastoral, non-forestry)	Land degradation and soil erosion
Secondary and tertiary industries	Forest resources	Conservation and natural heritage assessment
Traditional activities	Commercial and non commercial fisheries	Conservation and National Park management
Current administrative structures	Mineral resource potential and mining industry	
	Tourism industry	

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SUMMARY

The Golden-shouldered Parrot Psephotus chrysopterygius once occurred over much of central Cape York Peninsula. It is now confined to a few small areas each with small populations. The results of the first two years of a longer study suggest that the parrots have difficulty in obtaining sufficient food in the early wet season, particularly in areas distant from hills, and survival through this time is enhanced by the exposure of seed reserves by early wet season burns (storm burns).

It is thought that a decline in the frequency of storm burns, because of increased extent of dry season fires that consume the fuel that could be burnt later, is responsible for not only the decline of the parrot but also at least partly responsible for the increase in the density of woody weeds on Cape York Peninsula.

Predation during the breeding season also seems higher than can be sustained. The putative predator, the Pied Butcherbird Cracticus nigrogularis, could also have increased as the result of the altered fire regime.

This study also suggests that, at current levels, grazing poses a negligible threat to Golden-shouldered Parrot populations, but that increased stocking rates could cause a decline in important wet season foods.

1.0 INTRODUCTION

The Golden-shouldered Parrot *Psephotus chrysopterygius* is a small granivorous parrot that nests in the mounds of termites, usually *Amitermes scopulus*. It is found only on Cape York Peninsula.

Evidence that the numbers and distribution of the Golden-shouldered Parrot had declined led to the initiation, in 1992, of a research project funded initially by the Queensland Department of Environment and Heritage and Worldwide Fund for Nature (Australia). The project subsequently received substantial funding from the Australian Nature Conservation Agency. In the short term the project has aimed to establish the reasons for the decline of the parrot and determine ways in which this can be reversed. Ultimately appropriate conservation management should result in an increase in the parrots' numbers until it can be considered secure. This report is an interim report on the project.

Project NR21 is thus an on-going project that will continue until at least 1998. Involvement with CYPLUS was sought by the research team, who believed the examination of land use and environmental change on Cape York Peninsula that they were undertaking had wide implications for CYPLUS, and is likely to benefit interpretation of the inventories being established by other NRAP projects. Access to the CYPLUS data was considered necessary to understand the extent to which ecological processes occurring at the project study site were likely to be affecting the woodlands elsewhere in the Peninsula. Historically these ecological changes could have affected the range of the parrot, and could be affecting other woodland taxa. CYPLUS also supported research into the effects of fire on soil temperatures and ti-tree mortality.

2.0 ACTIVITY, LOCATION AND PERSONNEL

2.1 Activity

Field work within the CYPLUS area was undertaken on the following properties:

Surveys of current and former range
- Artemis Station
- Dixie Station
- Holroyd Station
- Imooya Station
- Kalinga Station
- Killarney Station
- Lakefield National Park
- Mary Valley Station
- Merapah Station
- Mt Croll Station
- Silver Plains Station
- Starke Station
- Rokeby National Park
- Violetvale Station

Surveys of bird abundance and vegetation structure in existing and former parrot habitat
- Artemis Station
- Dixie Station
- Mt Croll Station
- Rokeby National Park
- Violetvale Station

Assessment of baseline dry season abundance of parrots and other seed-eating birds
- Artemis Station
- Dixie Station
- Violetvale Station

Analysis of dry season feeding activity and food abundance
Studies of wet season feeding ecology
- Artemis Station
- Dixie Station

Studies of breeding biology and factors affecting breeding success
- Artemis Station
- Dixie Station

Analysis of nesting habitat and nest site selection
- Artemis Station
- Dixie Station
- Killarney Station

The effect of fire on habitat

Artemis Station
Dixie Station
Holroyd Station
Lakefield National Park
Mary Valley Station
Violetvale Station

Monitoring of grazing impacts

Artemis Station
Dixie Station
Violetvale Station

2.2 Location

Within the CYPLUS area of interest, sites on the following map sheets were visited:

Cape Melville
Coen
Cooktown
Ebagoola
Hann River
Mossman

2.3 Personnel

Dr Stephen Garnett, Avian Ecologist
Dr Gabriel Crowley, Botanist
Mrs Susan Shephard
Mr Daryn Storch
Mr Mark Tozer

3.0 RESEARCH RESULTS

3.1 Surveys of current and former range

Early records suggest the Golden-shouldered Parrot occurred throughout southern Cape York Peninsula. Specimens were obtained west of Croydon, near Aurukun, north of Coen, west of Port Stewart and at Violetvale Station and sightings were made in 1845 along the Mitchell River. The species now occurs at none of these sites, breeding having been confirmed only near Musgrave (probably no more than 150 nests/year) and west of Chillagoe (probably no more than 50 nests/year). There are reports from three other sites on Cape York Peninsula but all require confirmation. Even counting these reports, the total population is unlikely to exceed 500 pairs.

Modelling by ERIN under CYPLUS project NR19 using BIOCLIM and GARP suggests that the distribution of the species falls within a relatively narrow climatic range, and that it now occupies no more than a twentieth of that range.

3.2 Surveys of bird abundance and vegetation structure in existing and former parrot habitat

Surveys of bird abundance and vegetation structure were conducted on Artemis, Dixie, Mt Croll and Violetvale Stations and on Rokeby National Park. Analysis using Decoda suggest that sites at Coen and surrounding areas, from which the parrots have disappeared, differ significantly from those near Artemis, where the parrot still exists. At all sites overall bird densities were considerably lower than at sites sampled in a similar fashion in the Northern Territory and the Kimberley.

Results of these surveys were provided to CYPLUS project NR03.

3.3 Assessment of baseline dry season abundance of parrots and other seed-eating birds

Informal reports by volunteers have confirmed the present scarcity (and hence decline) of Black Treecreepers on Cape York Peninsula. Studies of feeding ecology of seed-eating finches (Black-throated, Masked and Doubled-barred Finches) by a masters student at James Cook University under our supervision suggest that there is little competition during the dry season as the food is super-abundant.

3.4 Analysis of dry season feeding activity and food abundance

Young parrots join flocks which stay together through the dry season, coalescing to form larger flocks as ephemeral water sources dry out. Initial analysis shows that seed availability at feeding sites exceeds average values in the landscape, as random searching locates few sites whose seed availability even approaches that of dry season feeding sites. Time expended on feeding indicated super-abundant food availability. Observations of parrot feed selection established a dry season preference for annual grass seeds (notably Fire Grasses Schyzachyrium spp.). Initial observations indicate abundance of preferred foods appears not to be limiting during the dry season, in the presence or absence of fire.

3.5 Studies of wet season feeding ecology

Feeding flocks were sought on foot and by motor-bike, and their behaviour monitored, including habitat choice, food-selection, feeding techniques and social interactions. Assessment of resource abundance was undertaken.

The parrots changed from their dry season feeding behaviour when seed of Fire Grasses became unavailable because of soaking, burial or germination or when ground-layer vegetation became too thick. However they returned to fire grass seed whenever suitable stocks could be located. This was possible in areas that were storm-burnt or in rocky areas that continued to have little vegetation cover for much longer than in unburnt; country with a fairly continuous ground cover.

Initially the parrots switched to the fallen seed of Glimmer Grass Planichloa nervilemma that could be eaten without husking, or to that of Pendent Milkdrop-Sedge Scleria rugosa, whose hard seed-coat had been softened by moisture.

When availability of fallen seed reached levels too low to sustain the parrots, they moved to plant shoots and flowers and eventually left the feeding areas. No mortalities that might have been caused by starvation were observed, but parrots became more difficult to locate. Flocks that persisted longest were on storm-burnt areas.

The parrots shifted to the new season's seeds as these became available, feeding directly from the plants. The parrots fed on grass seeds during a short flush of Cockatoo Grass Alloteropsis semialata on unburnt ground, continually shifting back to flower feeding. Seed availability was not sustained until about 12 weeks after the first heavy rains. Adequate availability was provided by a second, heavier flush of Cockatoo Grass on storm-burnt areas, and by other annual grasses (Barnyard Grass Echinochloa colona, Hairy Armgrass Urochloa piligera, Finger Grass Digitaria bicornis and Summer Grass D. ciliaris) and herbaceous plants (Sand Spurge Phyllanthus hebecarpus, Thin-leafed Spurge P. virgatus, Heliotrope Heliotropium sp., Shrub Violet Hybanthus enneaspermus, Spiderwort Aneilema sp. and Three-tooth Milkdrop-Sedge Scleria tricuspidata). Many of these species were more prolific on storm-burnt areas.

Lowered food availability was indicated by longer feeding bouts, e.g. the parrots spent most of the day feeding on Broad-leaved Ti-tree Melaleuca viridiflora flowers in the early wet season, but less than 2 hours a day feeding on Fire Grass seeds throughout the dry season and when adequate amounts were located in the wet season.

Breeding behaviour (nest scraping) was exhibited whenever abundant food was located, then interrupted as food supply dwindled at the feeding sites. Site-fidelity appeared to be maintained by many parrots until food supplies reached critically low levels, even when food was in greater supply within a few kilometres.

3.6 Studies of breeding biology and factors affecting breeding success

Courtship feeding was recorded within a few days of the first rain but no more breeding behaviour was seen until the first of the new season seed became available. The first eggs were found 1st March. The last young would have fledged, had they not been abandoned, 10th July.

In 1994 75 chambers were found within the study area. Of these 57 certainly contained eggs. Of the 258 eggs found 96 are thought to have resulted in fledglings. At 5 of the failed nests feathers were found suggesting predation of adults. Also the female at at least one of the successful nests was killed, though the male raised most of the brood, while another female lost her tail but survived.

Though the success rate is lower than for 1993 (18 chambers located, 16 with eggs; and 40 fledglings coming from 88 eggs), much of the difference can be explained by predation during March. Nest searching in 1993 began in April. The increase in the absolute number of nests found in 1994 can be explained by increased search effort.

The high level of predation is of concern and video cameras and automatic sensors were set up to determine the cause of predation. Unfortunately budgeting constraints and technical faults brought on by the rugged field conditions prevented their use until near the end of the season. Perversely three of the four nests at which the cameras were finally used proved successful and the last nest was abandoned.

From the nature of injuries to nestlings we believe the most likely predator to be the Pied Butcherbird *Cracticus nigrogularis*. Experimental studies in the Northern Territory suggest that the relative abundance of this species may have been affected by changes in fire regime. It is hoped to obtain further data in the 1995 breeding season when field-tested video equipment will be available.

Fire during the breeding season has also been mooted as a threat to breeding success. In 1994 fire burnt round 8 active nests without causing the death of any of the nestlings, though one clutch in a nest with particularly thin walls might have suffered, had it not already been the subject of predation. Internal nest temperatures during a fire were recorded as rising 3 degrees above the ambient temperature.

None of the nesting mounds were destroyed by cattle.

3.7 Analysis of nesting habitat and nest site selection

Golden-shouldered Parrots nest primarily along poorly-drained grassy flats within ti-tree and eucalypt woodland. They nest in termite mounds, principally those constructed by Amitermes scopulus. Initial analysis of vegetation around the mounds and other characteristics of the nest sites suggest that such sites are abundant in the landscape.

To determine growth and loss rates of nesting mounds several hundred have been individually measured. Initial projections suggest that smaller mounds may reach a size in which a nest could be constructed in about 20 years but that some of the larger mounds are probably more than a century old. The slow growth rates were corroborated by a visit from Mark Weaver, who worked on the parrots 10-15 years ago. He was able to identify individual mounds he had photographed 15 years ago. Not only had the mounds not grown appreciably but some still showed scars of nesting. Despite the slow growth rate, a shortage of suitable nesting habitat is not believed to be affecting the abundance of the parrots.

Sites where nesting was recorded in the 1920s now have neither suitable habitat, having completely occluded by Broad-leaved Ti-trees and having little grass cover and no termite mounds. It was considered that this change in habitat was a result of fire regime, but that it was secondary to the processes threatening the parrot, as it was either not evident, or only slightly advanced at many sites from which the parrot has now disappeared.

3.8 The effect of fire on habitat

Invasion of grassy flats by Broad-leaved Ti-tree was identified as a factor in the decline of suitable breeding areas for the parrot. Studies were undertaken to examine the use of fire to control this species.

Plants of Broad-leaved Ti-tree which had been burnt or cut (varying season, temperature and depth) were monitored. Survival through extremely hot fires during October 1993 was over 95% of tagged plants, and confirmed death less than 1%. Most experimental treatments resulted in little mortality. One hundred percent survival was exhibited by plants that had been burnt with a blow-torch to heat lignotubers at a depth of 2 cm to between 55 and 65°C in the early wet season but most of these plants showed weak recovery. They had red growth tips that were continually attacked by insects while plants cut before the first rains were already between 10 cm to 40 cm high at that stage. This suggests that burning in the early wet season may reduce plant vigour and eventually cause mortality of many plants.

As Broad-leaved Ti-trees regenerate from a buried lignotuber after severe fire damage, soil temperatures below 2 cm are considered important in determining the ability of fires to cause effective mortality. Soil temperatures of three fires were monitored for each of the three principal times at which fires presently occur on the Peninsula: late dry season, early wet season (storm time) and early dry season. All fires were in ti-tree low open woodland with a grassy understorey, or grassland with scattered Broad-leaved Ti-tree present. Temperatures were monitored using apparatus provided by the New South Wales National Parks and Wildlife Service. The fires monitored were either wildfires or lit as part of land management on the properties concerned. Late dry season fires were in November 1993, with a soil moisture of $<1\%$. Storm burns followed within a week of the first significant rains in late November 1993 of between 25 to 200 mm, and a soil moisture of about 1-2%. Early dry season fires were lit in late May 1994. Soil moisture data is not yet available.

In all fires soil temperatures below 2 cm failed to rise to lethal levels of >65°C. At a 2 cm depth there was generally a rise of between 12 and 18°C in soil temperature soon after the passing of the fire. Before-fire temperatures were generally between 25 and 35°C, leading to final temperatures of up to 45°C. In one late dry season fire, soil temperatures reached about half an hour after the fire with the sun shining on the blackened surface exceeded the peak temperature reached by the fire.

These results indicate that fires at any time of the year are unlikely to cause mortality of root-stock of ti-trees or other plants capable of re-sprouting from lignotubers. Mortalities are most likely to occur on days when surface soil temperatures exceed 50°C, or in isolated patches where fuel accumulation is high. However, high fuel loads are likely to protect the soil from insolation, and therefore keep initial soil temperatures low.

These results were confirmed by the analysis of ti-tree mortality. Virtually all ti-trees that suffered severe canopy scorch resprouted from the base, regardless of initial height. Growth rate was lowest for suckers below grass height, whether burnt or otherwise. It was greatest in suckers between grass height and 2 metres, the height at which most ti-trees can resprout from the crown. Thus the fire regime needed to control ti-trees needs to be of sufficient frequency to return suckers to ground level, an interval of at least every 3 to 4 years. To return trees to ground level needs a fire of great intensity backed up by a considerable fuel load. Such fires are likely to occur only during the afternoon in the late dry season or early wet season in places.

3.9 Monitoring of grazing impacts

Food eaten by cattle was sampled on a weekly basis for the first 6 months of 1994. Experimental plots were established to monitor the effect of different grazing regimes on survival and seed production in Cockatoo Grass Alloteropsis semialata.

Cattle were found to select a wide variety of grasses, with emphasis on perennial grasses, notably Cockatoo Grass (25-50% of feeding records), in the first weeks of the wet season. Annual grasses and newly germinated perennial grasses increased in importance as these became available. By 7 weeks into the wet season, Cockatoo Grass constituted less than 15% of weekly feeding records and emphasis had shifted to Fire Grasses and other annual grasses (18-58%). Annual grasses were no longer a significant component of the diet after they produced seed and died, and there was a strong return to Cockatoo Grass when it resprouted after fires in late May and early June.

One-off cutting or burning of Cockatoo Grass after the first significant wet season rains resulted in synchronised flowering and increased seed production, but a second cutting after one week reduced seed production to negligible levels and reduced plant vigour. Initial examination of the data suggests seed production in a grazed paddock was similar to that of ungrazed, control plants. This suggests that grazing at current levels is not deleterious to either plant health or seed availability, but that heavier stocking rates may be so.

3.10 Development of management recommendations

Recommendations on burning and grazing regimes were developed as part of a Golden-shouldered Parrot Recovery Plan (see Appendix).

3.11 Refinement of management recommendations in consultation with land managers

Management recommendations were presented at the first meeting of the Golden-shouldered Parrot Recovery Team, held on 22nd April 1994, which was attended by representatives of QDEH, CYPLUS, the major donor bodies and the managers of the land on which the parrots occur. The main conclusion for management, apart from continuation of the research, was that, if possible, the project should contribute resources to encourage storm-burning on Killarney and Kalinga Stations during the coming wet season.

4.0 CONCLUSIONS

The main findings evolving from this study are that the early wet season is a time of restricted food availability for the Golden-shouldered Parrot, and that any further pressure on limited food reserves may further reduce their populations. Food availability may have been sustained in the parrot's current range by a combination of storm-burning undertaken by present and past land-holders, and the presence of naturally bare areas on the edge of the Great Dividing Range. Conversely disappearance of parrots from other areas may have been caused by a decline in burning activity early in the wet season, and a lack of naturally open areas. It is hoped that recovery of the Golden-shouldered Parrot may be instigated by the adoption of storm-burning in those areas.

Storm-burning should also be seen as desirable if the initial finding of the burning experiments are supported by future monitoring. The ability of storm-burning to both suppress woody weeds and enhance seeding in Cockatoo Grass, an important wet season cattle-feed, would be of benefit to the grazing industry.

This study also suggests that, at current levels, grazing poses a negligible threat to Golden-shouldered Parrot populations, but that significant increases in stocking rates would need to be monitored carefully to ensure that a decline in Cockatoo Grass does not result.

APPENDIX TO FINAL REPORT CYPLUS PROJECT NR21

GOLDEN-SHOULDERED PARROT RECOVERY PLAN - MAY 1994

SUMMARY

Current Species Status:
Endangered (ANZECC, 1991); Endangered (Qld Nature Conservation Act 1992). Golden-shouldered Parrots are thought to have occurred over most of Cape York Peninsula early this century. Currently the population may not exceed 250 breeding pairs. There are two confirmed breeding populations, and three areas where birds have been reported but for which sightings have not yet been confirmed. The Golden-shouldered Parrot is considered endangered because the population is so small and may still be declining.

Habitat Requirements and Limiting Factors:
Golden-shouldered Parrots nest in termite mounds along the fringes of seasonally inundated grassy flats. They feed on both the flats and on the intervening ridges, from May to February feeding primarily in areas that have been recently burnt. Preliminary investigations suggest that when wet season rains makes the grass seed they eat in the dry season inaccessible, the parrots move to sites where vegetation is naturally sparse, such as gravelly hills, or sites that have been burnt early in the wet season. The factor thought to have had greatest impact on parrot numbers is a change in burning practices with too much of the habitat being burnt in the late dry season and not enough being burnt after the wet season has begun. Though such a change in burning practices is hard to prove and relies on the memories of long-term residents, it is thought that a lack of early wet season burning has exacerbated food shortages at a time when food is naturally scarce. It may also have resulted in an increase in the abundance of Pied Butcherbirds, which are known to prey on nestlings, and the invasion of the parrots' nesting habitat by woody weeds, principally tea-trees. Intense grazing pressure may affect the availability of the first grass seed to mature after the wet season has begun, Cockatoo Grass *Alloteropsis semialata*, which may be further affected if pastures are oversown with exotic legumes. However this is not currently considered a threat within the parrots' present range. Factors previously mooted as threats but which now seem unlikely are low intensity open range grazing, predation by cats or competition with other granivores. Illegal trapping for the bird trade may have affected some populations in the past but is now thought to be minimal.

Recovery Plan Objectives:
Downlisting to Vulnerable within 15 years, though monitoring will need to continue indefinitely.

Recovery Criteria:
(1) Increase in existing populations to re-occupy former range on stations adjacent to those currently occupied.
(2) Increase in population to >2500 individuals at the start of the breeding season, currently thought to be the equivalent of 1000 pairs.

Actions Needed:
A Recovery Team comprising members of the Queensland Department of Environment and Heritage, the Australian Nature Conservation Agency, the World Wide Fund for Nature (Australia), the Royal Australasian Ornithologists Union and a representative of properties on which the parrots occur will co-ordinate and supervise the following actions:
(1) Research into Golden-shouldered Parrot habitat requirements, threatening processes and distribution.
(2) Extension work among land managers to promote appropriate land management practices.
(3) Monitoring of the population to test trends in parrot numbers.
(4) Further actions based on the results of Actions 1-3 above.

Estimated Cost of Recovery: 1994 prices in $000's/year.

Actions	(1)	(2)	(3)	Total
1994/5	188.9	18.0		188.9
1995/6		32.5	56.0	88.5
1996/7		32.5	56.0	88.5
1997/8		32.5	56.0	88.5
Total	188.9	114.5	168.0	464.4

Biodiversity Benefits: The Golden-shouldered Parrot is the most threatened of a suite of bird species that have declined in the tropical savanna woodlands of northern Australia. Processes affecting the parrots are also likely to be affecting the other species.

INTRODUCTION

Description of species: A small granivorous parrot highly prized in aviculture in which the male is aquamarine and yellow with red vent and belly and the female is green and turquoise.

Distribution, past and present: Early records suggest the species occurred throughout Cape York Peninsula with specimens being obtained west of Croydon (Gould 1855), near Aurukun (McGillivray 1917), north of Coen, west of Port Stewart (White 1922) and at Violetvale Station (Thomson 1936) and sightings made in 1845 along the Mitchell River (Chisholm 1944). The species now occurs at none of these sites, breeding having been confirmed only at sites near Musgrave (probably no more than 100 nests) and west of the Lynd River on Bulimba Station and Staaten River National Park (probably no more than 50 nests). There are reports from three other sites on Cape York Peninsula but all require confirmation. Even counting these reports, the total population is unlikely to exceed 150 pairs. The decline may be continuing: of 14 nest sites known to have been occupied in 1992, only 7 were used in 1993 and none had been reoccupied by March 1994.

Habitat: Nests primarily along poorly-drained grassy flats within tea-tree and eucalypt woodland. During the breeding season feeds mostly on flats, the principal dietary items being seeds of the grasses *Alloteropsis semialata*, *Echinochloa colona* and several *Digitaria* spp. and the sedge *Scleria rugosa*. In the dry season moves to eucalypt woodland on the intervening ridges and other sites where there is a high concentration of the grasses *Schyzachyrium pachyarthron* and *S. fragile*. In the early wet season (one year's data) continues to feed on old grass seed, particularly in areas burnt by early wet season fires. When these run out, or are hidden by new grass growth, subsists on tea-tree flowers and the new growth of trees until new seed becomes available. In burnt areas this diet of flowers is combined with the seed from a range of herbs which respond rapidly to burning.

Life History/Ecology: In late wet season excavates nest in termite mounds and lays a clutch of 6 eggs. About 30% of these result in birds fledging (one year's data). Principal cause of loss of nestlings appears to be predation by Pied Butcherbirds but more data are needed. Mortality of newly fledged birds may be high (10% fledglings seen again) but cause is not yet known. Young birds join flocks which stay together through the dry season, coalescing to form larger flocks as ephemeral water sources dry out. In the early wet season, flocks in unburnt areas disperse, with at least some birds moving to burnt sites in the hills. Females may move further than males and surviving flocks have more males than females. Mortality at this time is thought to be high as a result of food shortages, especially among birds which do not find wet season food sources in burnt areas or in gravelly hills which are naturally sparse. Preliminary data suggest mortality may be high in adults as well as immature but more data are required.

Reasons for Listing: The range of the Golden-shouldered Parrot has contracted to a small fraction of its former extent and, despite about 30% nesting success (data from 1 year), there is no evidence that the decline has stopped. If there are indeed only 150 pairs then the species could slip from the Endangered to the Critical category.

Existing Conservation Measures: A recovery plan is being funded by ANCA, WWF and QDEH. A population is present on Staaten River National Park for which the fire management will be determined by the requirements of the species, when these are identified.

RECOVERY OBJECTIVE(S) AND CRITERIA

Objective: Downlisting to Vulnerable within 15 years by
(i) ensuring the species persists within its present range
(ii) increasing population numbers by expansion into former range.

Criteria: The criteria for achieving this objective will be:
(1) Increase in existing populations to reoccupy former range on stations adjacent to those currently occupied.
(2) Increase in population to >2500 individuals at the start of the breeding season, currently thought to be the equivalent of 1000 pairs.

RECOVERY ACTIONS

Action 1: Research into Golden-shouldered Parrot habitat requirements, threatening processes and distribution.

1.1: Ecological requirements. Determine seasonal dietary requirements, habitat use and breeding success to elucidate the timing and nature of mortality and threats.

1.2: Survey. Survey current and former distribution to determine current range and approximate population of species.

1.3: Community study. Survey habitat of current and former range, describing both vegetation and community of birds of which Golden-shouldered Parrot is a part to determine the extent and nature of change over time and to compare with other sites in northern Australia.

1.4: Woody weed invasion. Study of response of woody weeds and native grasses, particularly species used by Golden-shouldered Parrot, to different fire and grazing regimes.

1.5: Captive Studies. Feeding studies in captive Hooded and Golden-shouldered Parrots examining feeding behaviour, rate of intake, food digestibility.

1.6: Management unit identification. Determine management units on the basis of genetic variation in extant and extinct populations using mitochondrial DNA extracted from feathers of specimens.

1.7: Genetic fingerprinting/protection from poaching. Prevention of poaching needs to be tackled at the market end through using genetic fingerprinting to identify individuals. This can be done from blood or feathers. Analysis of blood easier but collection in the field far more difficult than for feathers. However technique for identifying individuals using genetic material collected from feathers needs to be perfected. Perfection of the technique will have significance for numerous other species for which fingerprinting will be a useful tool in protection.

1.8: Predation by cats. The threat of predation by cats is probably small but requires testing. Cats are shot regularly and their stomach contents analysed to build up a profile of prey types against which the characteristics of the Golden-shouldered Parrot can be tested.

1.9: Population viability analysis. Analysis of the probabilities of survival and the stages in the life history most likely to be critical to the species' survival.

1.10: Distribution modelling. Modelling of past and present distributions of Golden-shouldered and Hooded Parrots using BIOCLIM to determine possible distribution based on climatic and edaphic factors.

1.11: Food plant distribution. On the basis of results of Action 1.1 model existing and likely distribution of known food plants on the basis of data collected during vegetation mapping of Cape York Peninsula and determine which if any could limit the parrot's distribution.

Action 2: Extension work among land managers to promote appropriate land management practices

2.1. Land Management Guidelines. Prepare land management guidelines based on results of Action 1 and consult land managers to discuss the results of research work and recommendations for land management.

2.2: Extension. Consultation with land managers and publicity campaign to promote sustainable land management with particular reference to Golden-shouldered Parrot habitat.

2.3: Burning. Assistance with establishment of fire breaks and with lighting storm-burns, in consultation with similar programs on adjacent National Parks.

Action 3: Monitoring

3.1: Monitoring parrots. Regular visits to nesting sites to determine status of occupancy, observations of nesting birds to determine age and, when banded, history, banding of nestlings to enhance monitoring in later years and collection of genetic material to determine provenance and as partial protection against theft (see action 1.7). Would also visit adjacent properties to search for new populations. Staff could operate on a wage basis or on a contract as considered appropriate. Staff could also assist in dissemination of information to the public.

3.2: Monitoring effects of burning. Using aerial photographs, photopoints or other means, determine effects of burning program on vegetation structure.