The Birds of the Bush Heritage Cravens Peak Reserve

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Abstract Bird communities were studied in two subregional areas of Cravens Peak, the Toko Plains and the Simpson-Strzelecki Dunefields, using the point counts method. A total of 42 2ha 20 minute surveys, 46 five-hundred metre radius area surveys and 170 5km drive through area surveys were conducted and observations made. Bird species were identified, counted and recorded. The data were compared in the two subregions and, as a whole, considering species groups according to land system on which the ecosystem occurs, the specific ecosystem and according to their general feeding habits (insectivore, omnivore, frugivore, granivore, nectarivore and carnivore). Species richness and species relative abundance were compared using Simpson's Diversity Index and the data revealed that species are distributed largely on the basis of habitat. In general, areas with a greater number of vegetation strata recorded greater species diversity. Overall, the Tall Open *Acacia georginae* Shrubland on alluvial floodplains has a greater diversity of birds in a 2ha area (0.87, Simpson's Index of Diversity 1-D) compared to the other survey sites.

Introduction

This paper reviews the birds of the Craven Peak based on new data collected during ten days of surveying on the property from the 18th to 28th April 2007. Details of all birds recorded are provided and information on the frequency of occurrence in the region with that of habitat selection is summarised. The remoteness of much of the study area is an underlying cause of the lack of historical data on birds in this region. Recent neighbouring avifauna surveys occurred in 2006 and 2007 on Mulligan River Nature Reserve, where a total of 136 species was identified (Anderson, 2006).

Cravens Peak is located, 135kms south-west of Boulia, on the Queensland side of the Queensland and Northern Territory border. The 233,000 ha reserve is divided into two subregions, the Toko Plains and the Simpson-Strzelecki Dunefields (Sattler and Williams, 1999). Nationally, the property is located across the Channel Country and Simpson-Strzelecki Dunefields interim bioregions of Australia (Thackway, R. and Cresswell I, 1995). The property is bounded to the north and east by the Toko Range and to the west by the Toomba Range. This area together is called the Toko Plains subregion, and includes spectacular landforms such as gorges, dissected uplands, alluvial flats and gibber plains. Up through the middle of the property extends the northern section of the Simpson Desert with red sandy dunefields with an average dune height of 9m. Both subregions contain several claypans that at times fill to become ephemeral swamps.

The multiple aims of the present paper are;
1) To give an account of the avifauna species richness of Craven Peak, as a subset of its two subregions, Toko Plains and Simpson-Strzelecki Dunefields.
2) To compare species diversity to regional ecosystems, vegetation communities and general feeding habits.
3) To identify species and sites of notable conservation status.

Methods

Survey methodologies used in this report are based on *The New Atlas of Australian Birds* (Barrett et al.2003). Taxonomy and nomenclature is based on *Systematics and Taxonomy of Australian Birds* (Christidis, L. and Boles, W. 2008). Updated draft regional ecosystem mapping from the Queensland Herbarium has been used in this report for identifying habitat types across Craven Peak. The draft regional ecosystems used in this report are based on those defined by Sattler and Williams (1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.

Each species was placed in one of four categories of occurrence as defined below:
Sedentary – present in the region throughout the year.
Nomadic – occurrence in the region is dependent on unpredictable factors (e.g. rainfall). These species are often irruptive, so when present occur in large numbers.
Migratory – present in the study area between August and April.
Vagrant – occurs irregularly outside the normal identified range for the species.

Each bird species was placed in one of six primary feeding habits as defined below. However, most species will opportunistically eat a number of these food types:

Insectivore – consumes insects or other arthropods/small crustaceans.
Nectarivore – consumes the sugar-rich nectar produced by flowering plants.
Granivore – selectively consumes the nutrient-rich seeds produced by plants.
Herbivore – consumes plants (e.g. grass or aquatic plants).
Carnivore – consumes meat.
Frugivore - consumes fruit.

Birds were categorised into groups based on the Birds Australia Atlas survey form. These categorises are shpwn below:

EMBQ	- Emus, Mound Builders, Quail	NB	- Night Birds	WS	- Woodswallows
SGDG	- Swans, Geese, Ducks, Grebes	SK	- Swifts, Kingfishers	MB	- Magpie, Butcherbirds
HIS	- Herons, Ibis, Spoonbills	AWP	- Aust. Wrens, Pardalotes	RM	- Ravens, Mud-nesters
BOP	- Birds of Prey	SA	- Scrubwrens & Allies	BLP	- Bowerbirds, Larks, Pipit
BCR	- Brolgas, Crakes, Rails	H	- Honeyeaters	SF	- Sparrows, Finches
BBQ	- Bustard, Button-quail	CR	- Chats, Robins	SM	- Sunbird, Mistletoebird
W	- Waders	BW	- Babblers, Whipbirds	SB	- Swallows, Bulbul
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PD	- Pigeons, Doves	WST	- Whistlers, Shrike-thrushes	MS	- Myna, Starling
CP	- Cockatoos, Parrots	MF	- Magpie-lark, Flycatchers		
C	- Cuckoos	CSO	- Cuckoo-shrikes, Orioles		

Surveys were undertaken using `active timed area search' methodology of Birds Australia in three formats; 2ha 20 minute survey; within 500m area search; and large area search within 5km. An observer records the number of species seen while actively searching a certain area over a fixed time period (Field et al; Anjos, 2004). A stratified sampling method was used to select sites for field surveys. Accessibility and National Vegetation Information System (NVIS) were used to select the widest geographical spread of sites across the major vegetation communities (Table 1).

Table 1: Number of surveys to be completed and completed.

NVIS broad Floristics	Approximate % coverage of Craven Peak covered using NVIS.	Number of Surveys to be completed	Number of 500m Area Surveys Actually Completed according to NVIS	Number of 500m Area Surveys Actually Completed based on true reflection of R.E.
Eucalyptus woodland	0.5%	2	2	7 (5.3.5)
Acacia low open woodland	7.5%	3	3	2 (5.3.11)
Acacia sparse shrubland	10%	4	4	2 (5.6.2), 2 (5.7.12)
Acacia open shrubland	2.0%	2	0	5 (5.7.14), 3 (5.9.1)
Acacia low woodland	0.5%	2	0	0
Triodia low hummock grassland	33%	12	14	4 (5.6.6), 8 (5.6.7)
Triodia open hummock grassland	22%	9	1	0
Atriplex (mixed) open forbland	1.0%	2	3	0
Astrebla open tussock grassland	0.5%	2	2	2 (5.9.3)
Atriplex low sparse forbland	1.5%	2	0	0
Senna (mixed) tall sparse shrubland	5%	2	1	0
Aristida low sparse tussock grassland	15%	6	6	1 (5.9.4)
Centipeda tall sparse forbland	1.5%	2	10	10 (5.3.22)
		50 surveys	46 surveys	46 surveys

Avian communities were surveyed using the following three Birds Australia Atlas methods –

1. **2ha 20min Search** – This method involved searching a 2ha area for a set period of 20 minutes. Bird species and numbers of each species were recorded. Two hectares for ease of future surveying was defined as a circular area contained within a radius of 80m from a central GPS location. However, sites situated on creeks varied in structure to surveying 400m along the creek and 25m either side. Only birds within the 2ha area were recorded. Birds flying over were included in the count (e.g. foraging birds of prey). Waterbirds flying through not usually associated with the habitat being surveyed were not included (e.g. a pelican would not normally be associated with a dune). An Atlas Habitat Form was completed for each 2ha site surveyed.

2. **500m Area Search** – This method involved searching a circular area contained within a radius of 500m from a central GPS location. The presence of bird species was recorded. A 500m Area Search was conducted at each 2ha site. The 2ha survey was conducted prior to the 500m survey. The standard procedure was for surveyors to search for birds over a period of one hour, and
    a. If no new species was found in the last 15 minutes then the search was concluded at one hour.
    b. If a new species was found in the last 15 minutes then the surveyor continued searching for another 15 minutes after the one hour.
    c. If a new species was found in the next 15 minutes, then the surveyor continued for another 15 minutes.
    d. This survey technique was continued until no new species was found.

3. **1 Minute Grid Surveys (5km Area Survey)** – This method was used while surveyors travelled from one site to the next over a period of ten days. A surveyor would record all birds sighted within defined 1 minute grids. The standard procedure was that all vehicles travelling in a group would radio birds sighted to the lead vehicle as vehicles passed through defined grid zones. A new 1 minute grid zone was identified each time the minute on a GPS changed for either latitude or longitude and the lead vehicle would inform the other vehicles of a new survey. Over ten days, a list of birds was identified for each 1 minute grid zone providing, a wide-ranging representation of avifauna using particular vegetation communities.

Each survey site was identified with a set code (see Appendix 1). Codes stand for a description of site, landscape and vegetation as shown below:

(property)/ (surveyed from which camp or a known site)/ (general landform)/ (dominant vegetation). For example, CPSBUASX

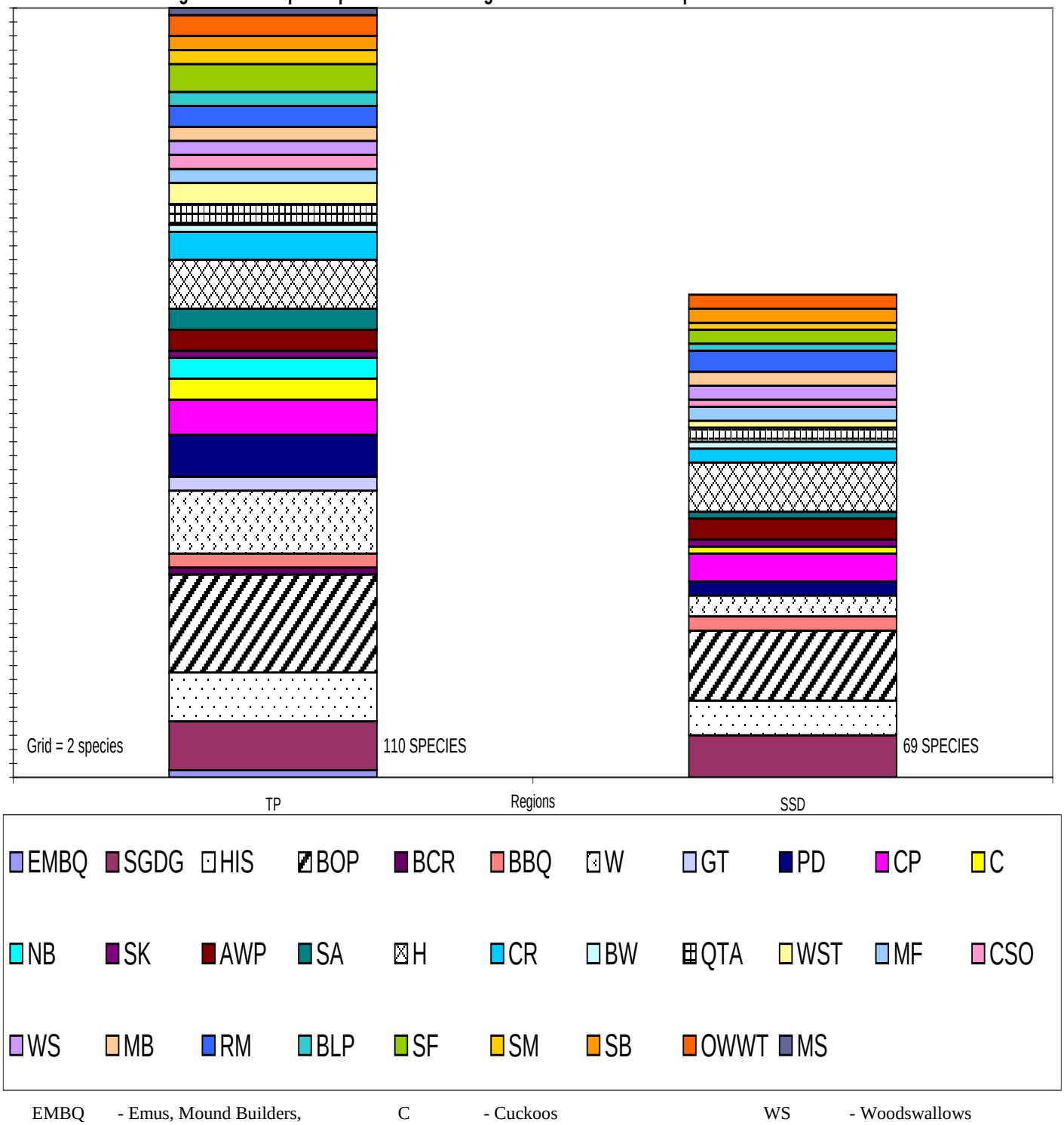
CP	Craven Peak,	SB	Salty Bore Campsite,	U	Upland Residual,	ASX	Acacia and Spinifex

Data collected for the 2ha surveys were analysed using **Simpson's Index of Diversity = 1 – [** $\frac{\sum n(n-1)}{N(N-1)}$ **]**, where **n** = the total number of individuals of a particular species and **N** = the total number of individuals of all species. Species diversity is a measure of the evenness of species and the species richness in a population (Offwell Woodland & Wildlife Trust, 2004).

Results

There was a difference in the number of bird groups and number of species between the Simpson-Strzelecki Dunefields and the Toko Plains subregions of Craven Peak. Twenty-six groups of birds were present in the Simpson-Strzelecki Dunefields subregion compared to thirty-one groups of birds in the Toko Plains subregion of Craven Peak. One hundred and ten species were identified in the Toko Plains subregion and sixty-nine species in the Simpson-Strzelecki Dunefields subregion. The Birds of Prey (BOP) constituted the largest representation in both subregions, however Waders (W) were the next most prevalent in the Toko Plains subregion and Honeyeaters (H) in the Simpson-Strzelecki Dunefields (Figure 1).

Fig 1: Bird Group Comparision of Two Regions - Toko Plains & Simpson-Strzelecki Dune Fields



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The Toko Plains subregion contained eight regional ecosystems (R.E. 5.3.5, 5.3.11, 5.3.22, 5.7.12, 5.7.14, 5.9.1, 5.9.3, and 5.9.4 whilst the Simpson-Strzelecki Dunefields contained only four regional ecosystems (R.E. 5.3.22, 5.6.2, 5.6.6, and 5.6.7). The sparse herbland on claypans, filled with water during the survey forming ephemeral lakes (R.E.5.3.22), contained the

highest species richness, 81 species. The alluvial open woodlands (R.E.5.3.5) interspersed with water-filled channels also contained high species richness at 70 species. These regional ecosystems are broadly described in Table 2 below and list the most abundant species found in these ecosystems. (Appendix 3 for visual characterisation)

Table 2: Regional ecosystem description, dominant vegetation and species at Craven Peak

Regional Ecosystem (Environmental Protection Agency, 2008)	**Location**	**Dominant vegetation height (m)**	**Number of vertical strata**	**No. of species**	**Dominant plants**	**Dominant species**
Alluvium open woodland (R.E.5.3.5)	Toko Plain	10-20	4-5	70	*Eucalyptus coolabah*	Black Kite, Little Button-quail, Crested Pigeon, Diamond Dove, Budgerigar, Cockatiel, Galah, Red-browed Pardalote, Variegated Fairy-wren, Singing Honeyeater, Yellow-throated Miner, Rufous Whistler, Magpie-lark, White-winged Triller, Black-faced Woodswallow, Masked Woodswallow and Zebra Finch
Sparse Herbland on claypans (Ephemeral Lake) These were often inundated after a recent major flood event (R.E.5.3.22)	Toko Plain and Simpson-Strzelecki Dunefields	0.5	1 dry And 5 wet	81	Variable herbs	Black Kite, Little Button-quail, Diamond Dove, Budgerigar, Galah, Magpie-lark, Black-faced Woodswallow, Masked Woodswallow, Willie Wagtail, Zebra Finch, Australian Wood duck, Hardhead, Blue-billed Duck, Grey Teal, Pink-eared Duck, Plumed Whistling Duck, Red-necked Avocet and Glossy Ibis.
Alluvium tall open shrubland (R.E.5.3.11)	Toko Plain	3-5	3-4	23	*Acacia georginae, Senna artemisioides*	Black Kite, Diamond Dove, Budgerigar, Cockatiel, Black-faced Woodswallow, Nankeen Kestrel, Crimson Chat and Zebra Finch
Interdunal tall open shrubland (R.E.5.6.2)	Simpson-Strzelecki Dunefields	3-5	3	27	*Acacia georginae, Eremophila obovata*	Black Kite, Little Button-quail, Crested Pigeon, Diamond Dove, Budgerigar, Galah, Variegated Fairy-wren, Singing Honeyeater, Crimson Chat, White-browed Babbler, Crested Bellbird, Willie Wagtail, White-winged Triller and Zebra Finch
Interdunal hummock grassland/Tall open shrubland (R.E.5.6.6)	Simpson-Strzelecki Dunefields	0.5-1	3	28	*Triodia basedowii predominates, some shrubs*	Black Kite, Little Button-quail, Diamond Dove, Budgerigar, Grey-headed Honeyeater, Singing Honeyeater, Black-faced Woodswallow, Zebra Finch
Interdunal tall open shrubland (R.E.5.6.7)	Simpson-Strzelecki Dunefields	0.3-4	3	42	*Triodia basedowii, Eucalyptus pachyphylla, Eucalyptus gamophylla*	Black Kite, Little Button-quail, Diamond Dove, Budgerigar, Grey-headed Honeyeater, Singing Honeyeater, Crimson Chat, Black-faced Woodswallow, Zebra Finch
Ironstone jump-up low woodland (R.E.5.7.12)	Toko Plain	7-10	2	24	*Acacia cyperophylla, Acacia aneura*	Nankeen Kestrel, Budgerigar, Crested Bellbird, Willie Wagtail, Zebra Finch
Jump-up open shrubland (R.E.5.7.14)	Toko Plain	4-7	2	39	*Acacia spp.* and *Hakea eyreana*	Black Kite, Brown Falcon, Little Button-quail, Diamond Dove, Budgerigar, Variegated Fairy-wren, Singing Honeyeater, Crimson Chat, Crested Bellbird, White-winged Triller, Black-faced Woodswallow, Zebra Finch.
Undulating country open shrubland (R.E.5.9.1)	Toko Plain	1-2	2	43	*Senna spp., Eremophila spp.*	Black Kite, Little Button-quail, Diamond Dove, Budgerigar, Variegated Fairy-wren, Singing Honeyeater, Rufous Whistler, Willie Wagtail, White-winged Triller, Black-faced Woodswallow, Zebra Finch
Undulating country tussock-grassland (R.E.5.9.3)	Toko Plain	0.6-1.2	1	18	*Astrebla pectinata*	Black Kite, Brown Falcon, Budgerigar, Cockatiel, Galah, Zebra Finch, Brown Songlark
Undulating country sparse-tussock grassland (R.E.5.9.4)	Toko Plain	0.2 -0.3	1	19	*Aristida contorta*	Black Kite, Brown Falcon, Diamond Dove, Budgerigar, Cockatiel, Galah, Spotted Nightjar, Willie Wagtail, Zebra Finch, Brown Songlark

Seven sites in Toko Plains subregion surveyed had twenty-eight or more species; all were associated with water (creeks or ephemeral swamps). Two sites had fewer than ten species; both were on *Aristida contorta* sparse tussock grasslands around Salty Bore (Figure 2).

Three sites in Simpson-Strzelecki Dunefields subregion had twenty-six or more species; all were associated with water (ephemeral swamps) (Figure 3).

Birds of prey are dominant in all landforms. Honeyeaters are abundant in dunes, alluvial flats, jump-ups and undulating country. Cockatiels and parrots are abundant on alluvial flats, and waders are abundant in ephemeral swamps (Figure 4).

Fig 2: Toko Plain Number of Species per Group per site

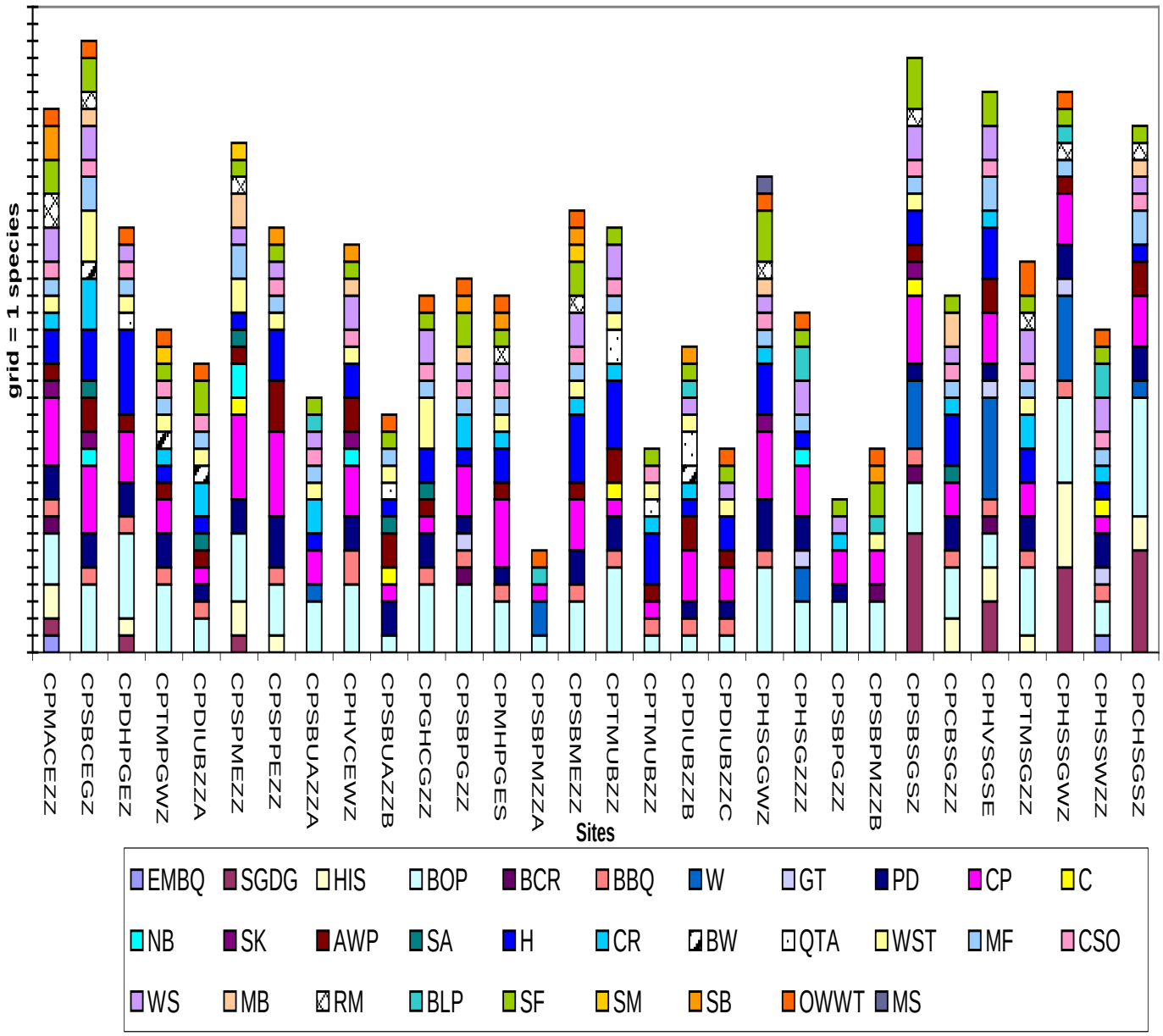

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Fig 3: Simpson-Strzelecki Dune Fields Number of Species per Groups per site MF - Magpie-lark, Flycatchers

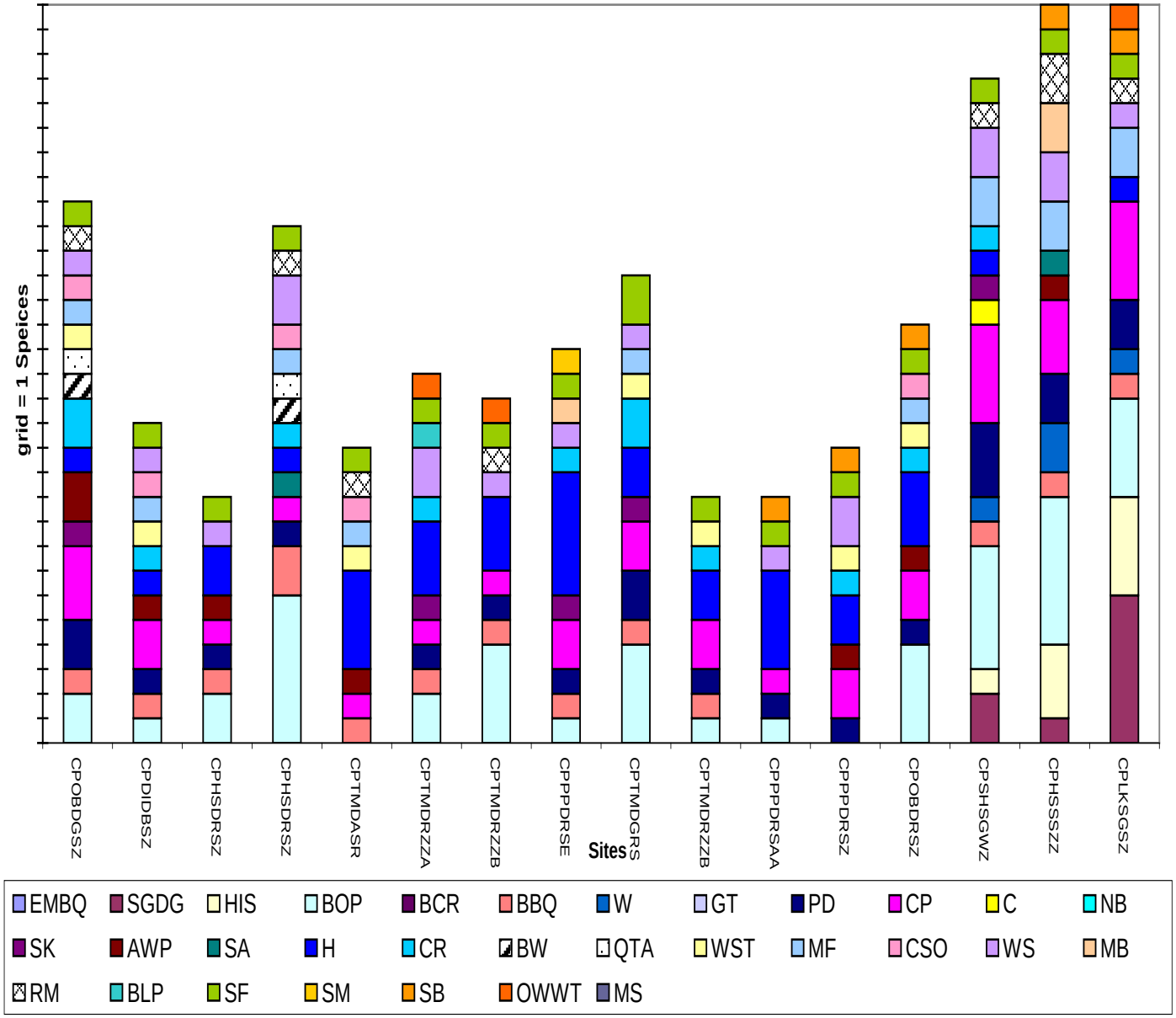

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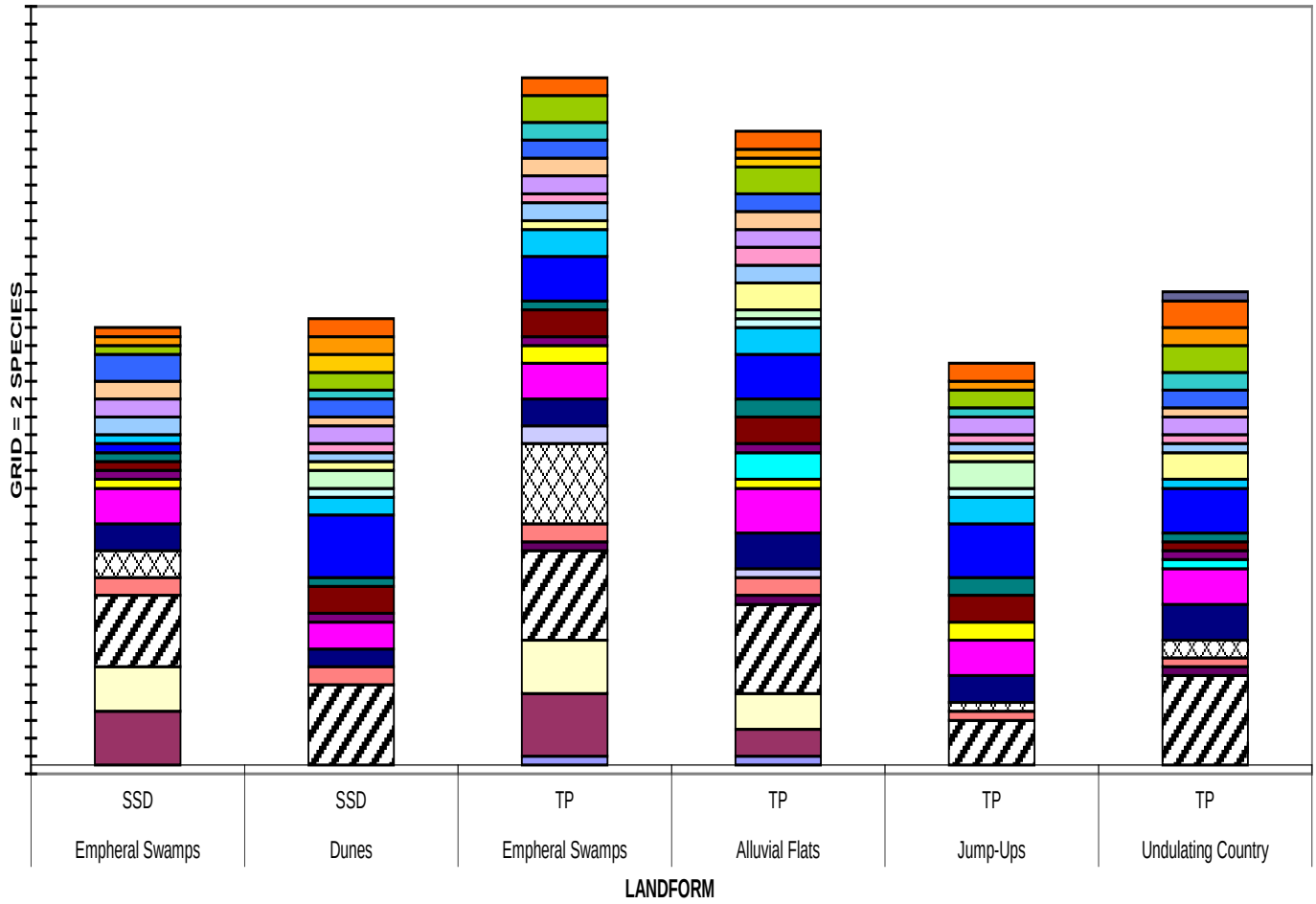
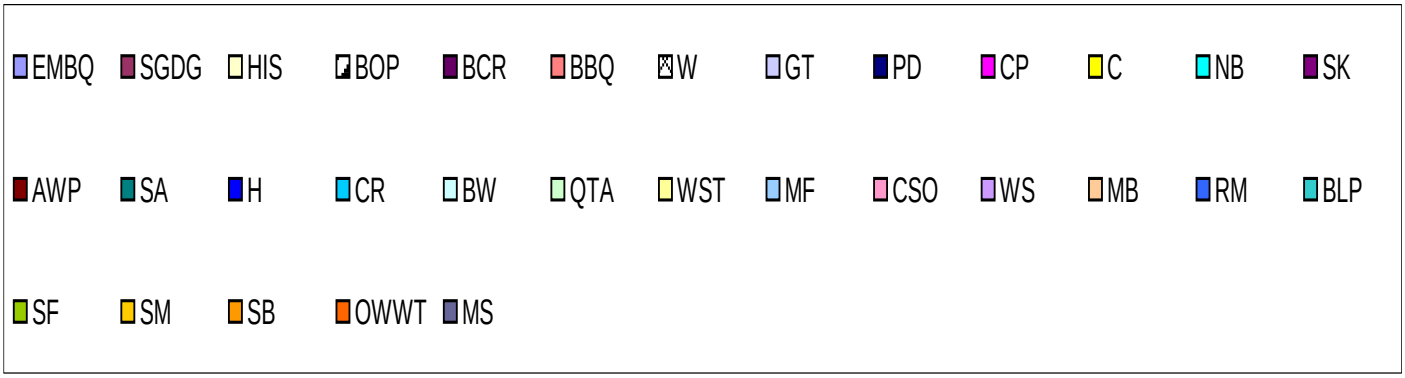
Fig 4: NUMBER OF BIRD SPECIES IN EACH LANDFORM TYPE





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Swamps and areas associated with water had the highest Simpson's Diversity index. Ecosystems with high numbers of strata had higher diversity (Table 3).

Table 3: 2ha Surveys of Craven's Peak – Species diversity in varying numbers of strata

Habitat Description	Regional Ecosystem	No. of Strata	Simpson's Diversity Index
Open *Eucalyptus* woodland on floodplain	5.3.5	5	0.74
Sparse Herbland (Empheral Swamps)	5.3.22	5	0.77
Tall Open *Acacia georginae* Shrubland on floodplain	5.3.11	4	0.82
Interdunal Tall Open Shrubland *Acacia georginae* dominate	5.6.2	3	0.71
Interdunal Tall Open *Eucalyptus pachyphylla* and *Eucalyptus gamophylla* Shrubland	5.6.7	3	0.70
Interdunal Hummock Grassland/ Mixed Tall Open Shrubland	5.6.6	3	0.60
Undulating country *Senna spp.* and *Eromophilla spp.* open shrubland	5.9.1	2	0.57
Acacia spp. and *Hakea eyrenana* Open Shrubland on scarps and hills	5.7.14	2	0.42
Acacia cyperophylla low Woodland on scarps and hills	5.7.12	2	0.39
Undulating country *Aristida contorta* Sparse-Tussock-Grassland	5.9.4	1	0.46
Undulating country *Astrebla pectinata* Tussock-Grassland	5.9.3	1	0

Figure 5 and 6 show that the majority of the birds at Craven Peak are nomadic and either insectivorous or granivorous in feeding habit. This is similar to the finding of Ziembicki (2007), who states that “a large proportion of birds in the monsoonal and arid grasslands of Australia are characterised by dispersive, nomadic movements and large population fluctuations in response to variable climatic conditions”.

Fig 5: Categories of Occurrence

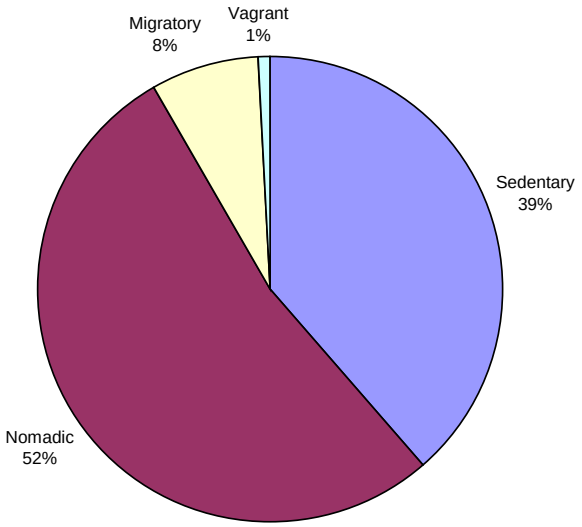
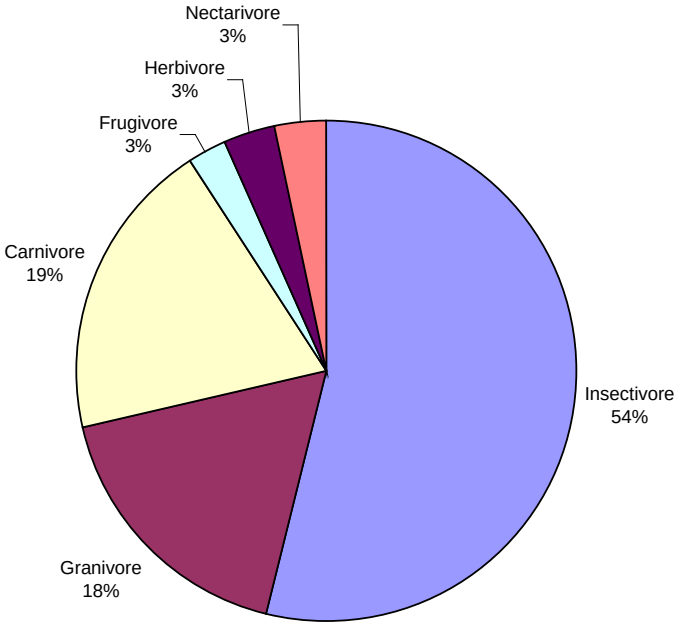


Fig 6: Feeding Habits



Discussion

A total of 119 species of birds distributed among 48 families and 18 orders (Appendix 2), were encountered in the Craven Peak Bush Heritage Reserve over the study period. Of these, 110 were found in the Toko Plains subregion and 69 in the Simpson-Strzelecki Dunefields (Figure 1).

Three weeks prior to undertaking the survey, Craven Peak received significant amounts of rain, many areas in the south and in the far north of the property were inaccessible due to the roads being flooded and unable to be traversed. Many of the low lying clay pans filled with water and became expansive lakes, cutting roads in half. Sites containing regional ecosystems 36 (Hard Spinifex Hummock Grasslands), 22% of the vegetation type, and regional ecosystem 50 (Fluctuating climax of Barley Mitchell Grass, Bindieyes & Daisies Sparse-Herbland), 2% of the vegetation type, could not be sampled. The number of ephemeral lakes (on a property which has very few working turkey nest dams, permanent water or natural springs) increased (Table 1). When filled turkey nest dams become an important source of water for birds at Cravens Peak, during times of scarce rainfall.

Toko Plains contained more regional ecosystem communities than the Simpson-Strzelecki Dunefields, eight and four regional ecosystems, respectively. This diversity in habitats was also reflected in the number of species of birds identified: 110 and 69 species, respectively.

Ephemeral swamps were more prevalent on the Toko Plains subregion (ten sites), whereas the Simpson-Strzelecki Dunefields subregion contained three sites.

Species richness, the number of species found in a particular ecosystem, was highest in ecosystems associated with water, such as ephemeral swamps on claypans (80 species) and channel country with numerous creeks (65 species).

Species diversity, a measure of the species richness and evenness (relative abundance of the different species), was highest in regional ecosystems associated with water, shrubland on floodplains (0.85), ephemeral swamp (0.77) and woodland on floodplains (0.74).

Thinh (2006) states that “vegetation structure explains well bird species diversity”. At Cravens Peak, those ecosystems with the greatest number of strata (4 - 5 strata) had the greatest species diversity (average 0.76) while those with the least numbers of strata had the lowest, 3 strata (average 0.71), 2 strata (average 0.52) and 1 stratum (average 0.26). Of note was regional ecosystem 5.3.22 (sparse herbland). During dry seasons, this ecosystem would contain one stratum; however, when water fills these claypans to form ephemeral swamps, the number of strata increased. In this study, the surrounding herbland, shallow water, aquatic vegetation, deep water and isolated shrubs/trees all constituted different strata within the habitat and therefore this ecosystem was regarded as having five strata, due to the recent filling event.

Important Bird Areas (IBAs) are sites of global bird conservation importance (Birds Australia, online 2008). They are priority areas for bird conservation. Cravens Peak meets IBA criteria and should be managed to conserve the birds identified as a globally threatened, restricted range and biome-restricted site. A site is defined as “Global Threatened” if it regularly holds significant numbers of a globally threatened species or other species of global conservation concern. Cravens Peak birds identified in this category are Grey Falcon (2% of surveyed sites) and Blue-billed Duck (2%). Other researchers on the property have identified Plains-wanderer; however, no sighting of this species was made during the ten day survey.

A site is defined as “Restricted-range” if it is known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area or Secondary Area. Endemic Bird Areas are defined as places where two or more species of restricted range occur together. Secondary Areas usually have just one restricted-range species confined to the area. Craven Peak would be defined as an Endemic Bird Area as it contains more than one restricted-range species - the Australian Bustard (9% of surveyed sites) and Pictorella Mannikin (15%).

A site is defined as “Biome-restricted” if it is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome. Craven Peak falls under the Australian arid zone biome and birds identified at Craven Peak falling in this category are the Grey Falcon (2% of surveyed sites), Banded Whiteface (4%), Grey-headed Honeyeater (30%), Pied Honeyeater (7%), Black Honeyeater (17%), Grey Honeyeater (2%), Gibberbird (2%), Chiming Wedgebill (9%), Cinnamon Quail-thrush (7%), and Painted Finch (9%).

Cravens Peak Bush Heritage Reserve, with 119 species and nine regional ecosystems, is a site of Australian and Global conservation significance for the birds.

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References

Anderson, E. (2006). Birds Australia Southern Queensland Bird Survey of Mulligan River Nature Reserve 23 June to 6 July 2006. Retrieved April 18, 2008, from http://www.basq.org.au/active/mulligan/mulligan2006.pdf

Anjos, L. (2004). Species richness and relative abundance of birds in natural and anthropogenic fragments of Brazilian Atlantic forest. Annuals of the Brazilian Academy of Sciences, 76, (2), 429 – 434.

Barrett, G., Silcocks, A., Barry, S., Cunningham,R. and Poulter, R. (2003) The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Hawthorn East.

Birds Australia. (online 2008) Important Bird Areas. http://www.birdsaustralia.com.au/our-projects/important-bird-areas.html , Twenty4, Melbourne.

Christidis, L. and Boles, W. (2008). Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Collingwood.

Environmental Protection Agency (2008). Regional Ecosystems Retrieved April 18, 2008 from http://www.epa.qld.gov.au/nature_conservation/biodiversity/regional_ecosystems/

Field, S., Tyre, A., and Possingham, H. (2002). Estimating bird species richness: how should repeat surveys be organized in time? Austral Ecology, 27, 624 – 629.

Offwell Woodland & Wildlife Trust (2004) Simpson's Diversity Index. Retrieved April 18, 2008 from http://www.countrysideinfo.co.uk/simpsons.htm

Pizzey, G. and Knight, F. (2007). The Field Guide to the Birds of Australia. 8th ed. Harper Collins Publishers, Sydney.

Reader's Digest. (1990). Complete Book of Australian Birds. Revised. Readers Digest, Surry Hills

Sattler, P.S. and Williams, R.D. (1999) The Conservation Status of Queensland's Bioregional Ecosystems. Queensland Environmental Protection Agency, Brisbane.

Thackway, R. & Cresswell I.D. (1995). An Interim Biogeographical Regionalisation for Australia: a Framework for Setting Priorities in the National Reserves System Cooperative Program, Australian Nature Conservation Agency, Canberra, ACT.

Thinh, V. (2006). Bird species richness and diversity in relation to vegetation in Bavi National Park, Vietnam. Ornithol Sci, 5, 121 – 125.

Ziembicki, M. (2007). Ecology and conservation of a nomad: a case study using the Australian bustard. Retrieved April 18, 2008, from http://savanna.ntu.edu.au/education/mark_ziembicki.html

Appendix 1 Sites

SITE	LATITUDE	LONGITUDE
CPSBPGZZ	23 02 29	138 16 38
CPCBSGZZ	23 00 29	138 03 40
CPCHSGSZ	23 22 02	138 35 52
CPHSSGWZ	23 20 18	138 35 49
CPHSSSZZ	23 17 23	138 33 03
CPHSSWZZ	23 21 15	138 36 44
CPHVSGSE	23 01 03	138 10 20
CPLKSGSZ	23 20 35	138 14 58
CPSBSGSZ	22 59 45	138 14 09
CPSHSGWZ	23 15 39	138 32 05
CPTMSGZZ	23 03 48	138 11 24
CPDHPGEZ	23 16 38	138 04 10
CPHVCEWZ	23 00 59	138 11 50
CPMACEZZ	22 53 46	138 02 11
CPSBCEGZ	23 01 10	138 12 45
CPSBMEZZ	22 56 52	138 09 38
CPSPMEZZ	23 03 48	138 20 49
CPSPPEZZ	23 04 33	138 18 18
CPOBDGSZ	23 14 13	138 13 36
CPTMPGWZ	23 09 35	138 09 21
CPDIDBSZ	23 18 59	138 14 22
CPTMDASR	23 04 18	138 06 38
CPTMDRZZA	23 06 09	138 10 24
CPTMDRZZB	23 06 27	138 07 45
CPHSDRSZ	23 11 52	138 24 34
CPHSDRSZ	23 11 52	138 24 34
CPOBDRSZ	23 14 07	138 14 35
CPPPDRSAA	23 08 33	138 20 56
CPPPDRSE	23 06 38	138 19 31
CPPPDRSZ	23 11 57	138 21 27
CPTMDGRS	23 07 27	138 08 17
CPTMDRZZC	23 07 34	138 10 11
CPSBUAZZA	22 59 06	138 10 41
CPSBUAZZB	23 01 28	138 13 55
CPDIUBZZA	23 16 54	138 13 15
CPDIUBZZB	23 14 24	138 10 04
CPDIUBZZC	23 14 43	138 08 55
CPTMUBZZ	23 10 53	138 10 53
CPTMUBZZ	23 10 53	138 10 53
CPGHCGZZ	23 14 29	138 07 15
CPHSGGWZ	23 19 23	138 35 26
CPMHPGES	23 11 42	138 12 29
CPSBPMZZA	22 55 35	138 06 14
CPSBPMZZB	22 54 26	138 03 49
CPHSGZZZ	23 22 56	138 38 31

Each survey site was identified with a set code. Codes stand for a description of site, landscape and vegetation as shown below:

(property)/ (surveyed from which camp or a known site)/ (general landform)/ (dominant vegetation).

Property: (1st two letters)
CP – Craven Peak

Surveyed from: (2nd two letters)
SB – Salty Bore
TM – Twelve Mile
DH – Duck Hole
GH – Gap Hole
LK – Little Kunnamuka
CB – Corner Bore
DI – Dingo Hole
OB – Ocean Bore
PP – Plum Pudding
SP – Star Picket
HV – Hidden Valley
MA – Malvine Creek
CH – Coolabah Waterhole
HS – Homestead
SH – Sandhill Bore

Landform: (next letter)
U – Upland Residuals
D – Dunes
C – Creek
S – Swamp
M – Mulligan River
G – Gibber Plain
P – Plain

Dominant Vegetation: (rest of letters)
A – *Acacia* sp. Shrubland
R – Mallee
G – Gidgee
S – Spinifex (*Triodia* sp.)
M – Mitchell Grass (*Astrebla* sp.)
W – Wiregrass (Aristrida sp.)
E – Eucalyptus trees (*E. camaldulensis*/*E. coolabah*)
B – *Acacia aneura* complex (Mulga)
Z – Vegetation not identified.

Appendix 2 List of bird species recorded over ten days

Order & Family Christidis, L and Boles, W. (2008)	**Species**	**Status**	**Distribution**	**Feeding habit**
		Pizzey, G and Knight, F. (2007) 8th Ed.		Reader's Digest (1990)
Order Anseriformes				
Anatidae (Ducks & Swan)	Plumed Whistling-Duck	Secure	Nomadic	Herbivore
	Grey Teal	Secure	Nomadic	Herbivore
	Blue-billed Duck	Vulnerable	Uncommon, Nomadic	Insectivore
	Australian Wood Duck	Secure	Abundant, Nomadic	Herbivore
	Pink-eared Duck	Secure	Nomadic	Herbivore
	Hardhead	Secure	Nomadic	Insectivore
Order Podicipediformes				
Podicipedidae (Grebes)	Australasian Grebe	Secure	Uncommon, Nomadic	Insectivore
	Hoary-headed Grebe	Secure	Scarce, Nomadic	Insectivore
Order Ciconiiformes				
Ardeidae (Herons & Egret)	White-faced Heron	Secure	Common, Nomadic	Carnivore
	White-necked Heron	Secure	Common, Nomadic	Carnivore
	Nankeen Night Heron	Secure	Scarce, Nomadic	Carnivore
Threskiornithidae (Ibis & Spoonbills)	Glossy Ibis	Secure	Uncommon, Nomadic	Insectivore
	Australian White Ibis	Secure	Common, Nomadic	Insectivore
	Straw-necked Ibis	Secure	Common, Nomadic	Insectivore
	Yellow-billed Spoonbill	Secure	Common, Nomadic	Carnivore
Order Acciptriformes				
Accipitridae (Kites, Goshawks, Eagles, Harriers)	Swamp Harrier	Vulnerable	Uncommon, Nomadic	Carnivore
	Spotted Harrier	Secure	Common, Nomadic	Carnivore
	Wedge-tailed Eagle	Secure	Common, Sedentary	Carnivore
	Black Kite	Secure	Common, Nomadic	Carnivore
	Black-breasted Buzzard	Secure	Common, Sedentary	Carnivore
	Brown Goshawk	Secure	Common, Sedentary	Carnivore
	Collared Sparrowhawk	Secure	Common, Sedentary	Carnivore
	Little Eagle	Secure	Uncommon, Nomadic	Carnivore
	Whistling Kite	Secure	Common, Nomadic	Carnivore
Order Falconiformes				
Falconidae (Falcons)	Brown Falcon	Secure	Common, Nomadic	Carnivore
	Nankeen Kestrel	Secure	Common, Nomadic	Insectivore
	Australian Hobby	Secure	Uncommon, Sedentary	Carnivore
	Black Falcon	Secure	Uncommon, Sedentary	Carnivore
	Grey Falcon	Near-Threatened	Rare, Nomadic	Carnivore
Order Gruiformes				
Gruidae (Cranes)	Brolga	Secure.	Uncommon/Dispersive, Nomadic	Carnivore
Otididae (Bustards)	Australian Bustard	Near-Threatened/ Vulnerable	Uncommon, Nomadic	Carnivore
Order Charadriiformes				
Scolopacidae (Sandpipers & allies)	Latham's Snipe	Secure.	Uncommon, Migratory	Insectivore
	Marsh Sandpiper	Secure.	Uncommon, Migratory	Insectivore
Turnicidae (Button-quails)	Little Button-quail	Secure.	Common, Nomadic	Granivore
Recurvirostridae (Stilts & Avocets)	Black-winged Stilt	Secure	Common, Nomadic	Insectivore
	Red-necked Avocet	Secure	Common, Nomadic	Insectivore
Charadriidae (Plovers & allies)	Red-capped Plover	Secure	Nomadic	Insectivore
	Black-fronted Dotterel	Secure	Common, Nomadic	Insectivore
	Red-kneed Dotterel	Secure	Nomadic	Insectivore
	Banded Lapwing	Secure	Common, Nomadic	Insectivore
Pedionmidae (Plains-wanderer)	Plains-wanderer – sighted by other researchers	Endangered	Rare, Sedentary	Granivore
Glareolidae (Pratincoles)	Australian Pratincole	Secure	Common, Nomadic	Insectivore
Laridae (Gulls & Terns)	Silver Gull	Secure	Sporadic, Nomadic	Carnivore
	Gull-billed Tern	Secure	Sporadic, Nomadic	Carnivore
Order Casuariiformes				
Casuariidae (Emu)	Emu	Secure	Abundant, Nomadic	Frugivore
Order Galliformes				
Phasianidae (Pheasant, Grouse, Turkeys, Partridges)	Stubble Quail	Secure	Common, Nomadic	Granivore

Order & Family	Species	Status	Distribution	Feeding habit
Order Columbiformes				
Columbidae (Pigeons, Doves)	Common Bronzewing	Secure	Nomadic	Granivore
	Crested Pigeon	Secure	Common, Sedentary	Granivore
	Diamond Dove	Secure	Nomadic	Granivore
	Flock Bronzewing	Secure	Common, Nomadic	Granivore
	Peaceful Dove	Secure	Common, Sedentary	Granivore
	Spinifex Pigeon	Secure	Common, Sedentary	Granivore
Order Psittaciformes				
Psittacidae (Rosellas and Lorikeets)	Australian Ringneck	Secure	Common, Sedentary	Granivore
	Budgerigar	Secure	Nomadic	Granivore
Cacatuidae (Cockatoos and Corellas)	Cockatiel	Secure	Nomadic	Granivore
	Galah	Secure	Common, Sedentary	Granivore
	Little Corella	Secure	Nomadic	Granivore
Order Cuculiformes				
Cuculidae (Old World Cuckoos)	Channel-billed Cuckoo	Secure	Uncommon Migrant	Frugivore
	Horsfield's Bronze-Cuckoo	Secure	Common, Vagrant	Insectivore
	Pallid Cuckoo	Secure	Common, Migrant	Insectivore
Order Apodiformes				
Aegothelidae (Owlet-nightjars)	Australian Owlet-nightjar	Secure	Common, Sedentary	Insectivore
Order Caprimulgiformes				
Eurostopodidae (Nightjars)	Spotted Nightjar	Secure	Sedentary	Insectivore
Order Strigiformes				
Strigidae (Typical Owls)	Southern Boobook	Secure	Common, Sedentary	Carnivore
Order Coraciiformes				
Halcyonidae (Halcyonid Kingfishers)	Red-backed Kingfisher	Secure	Nomadic	Insectivore
Meropidae (Bee-eaters)	Rainbow Bee-eater	Secure	Common, Migratory	Insectivore
Order Passeriformes				
Maluridae (Fairy-wrens and Allies)	Variegated Fairy-wren	Secure	Common, Sedentary	Insectivore
	White-winged Fairy-wren	Secure	Common, Sedentary	Insectivore
Meliphagidae (Honeyeaters, Chats)	Yellow Chat	Endangered	Rare, Sedentary	Insectivore
	Crimson Chat	Secure	Common, Nomadic	Insectivore
	Black Honeyeater	Secure	Common, Nomadic	Nectarivore.
	Gibberbird	Secure	Uncommon, Nomadic	Insectivore
	Grey Honeyeater	Endangered	Rare, Nomadic	Insectivore
	Grey-headed Honeyeater	Secure	Common, Nomadic	Nectarivore.
	Pied Honeyeater	Secure	Rare, Nomadic	Nectarivore.
	Black-chinned Honeyeater	Secure	Uncommon, Nomadic	Insectivore
	Singing Honeyeater	Secure	Common, Nomadic	Nectarivore.
	Spiny-cheeked Honeyeater	Secure	Common, Nomadic	Insectivore
	White-fronted Honeyeater	Secure	Common, Nomadic	Insectivore
	White-plumed Honeyeater	Secure	Common, Nomadic	Insectivore
	Yellow-throated Miner	Secure	Common, Nomadic	Insectivore
Pardalotidae (Pardalotes)	Red-browed Pardalote	Secure	Common, Sedentary	Insectivore
Acanthizidae (Gerygones and Thornbills)	Banded Whiteface	Secure	Uncommon, Nomadic	Insectivore
	Chestnut-rumped Thornbill	Secure	Common, Nomadic	Insectivore
	Redthroat	Vulnerable	Uncommon, Sedentary	Insectivore
	Weebill	Secure	Common, Nomadic	Insectivore
Petroicidae (Australo-Papuan Robins)	Hooded Robin	Secure	Uncommon, Sedentary	Insectivore
	Red-capped Robin	Secure	Common, Nomadic	Insectivore
Pomatostomidae (Australo-Papuan Babblers)	White-browed Babbler	Secure	Common, Sedentary	Insectivore

Order & Family	Species	Status	Distribution	Feeding habit
Order Passeriformes				
Corvidae (Ravens and Crows)	Australian Raven	Secure	Common, Sedentary	Carnivore
	Little Crow	Secure	Abundant, Nomadic	Insectivore
	Torresian Crow	Secure	Common, Sedentary	Insectivore
Artamidae (Woodswallows, Butcherbirds, Currawongs and magpies)	Australian Magpie	Secure	Common, Sedentary	Insectivore
	Black-faced Woodswallow	Secure	Common, Sedentary	Insectivore
	Masked Woodswallow	Secure	Common, Migratory	Insectivore
	Pied Butcherbird	Secure	Common, Sedentary	Insectivore
Monarchidae (Flycatchers, Monarchs)	Magpie-lark	Secure	Abundant, Sedentary	Insectivore
Pachycephalidae (Whistlers, Shrike-thrush and Bellbirds)	Crested Bellbird	Secure	Common, Sedentary	Insectivore
	Grey Shrike-thrush	Secure	Common, Sedentary	Insectivore
	Rufous Whistler	Secure	Common, Sedentary	Insectivore
Campephagidae (Cuckoo-shrikes and Trillers)	Black-faced Cuckoo-shrike	Secure	Common, Nomadic	Insectivore
	White-winged Triller	Secure	Common, Migratory	Insectivore
Neosittidae (Sittella)	Varied Sittella	Secure	Common, Sedentary	Insectivore
Psophodidae (Quail-thrush and Wedgebills)	Cinnamon Quail-Thrush	Secure	Common, Sedentary	Insectivore
	Chiming Wedgebill	Secure	Common, Sedentary	Insectivore
Rhipiduridae (Fantails)	Willie Wagtail	Secure	Common, Nomadic	Insectivore
Sturnidae (Starlings, Mynas)	Common Starling (introduced)	Secure	Common, Nomadic	Insectivore
Hirundinidae (Swallows, Martins)	Fairy Martin	Secure	Uncommon, migratory	Insectivore
	Tree Martin	Secure	Common, Migratory	Insectivore
	White-backed Swallow	Secure	Uncommon, Sedentary	Insectivore
Megaluridae (Old World Warblers and Allies)	Little Grassbird	Secure	Common, Sedentary	Insectivore
	Brown Songlark	Secure	Common, Sedentary	Granivore
	Rufous Songlark	Secure	Common, Sedentary	Granivore
Alaudidae (Old World Larks)	Horsfield's Bushlark	Secure	Common, Sedentary	Granivore
Nectariniidae (Sunbirds, Sugarbirds, Flowerpeckers)	Mistletoebird	Secure	Common, Sedentary	Frugivore
Motacillidae (Pipits)	Australasian Pipit	Secure	Common, Sedentary	Insectivore
Passeridae (Sparrows)	House Sparrow (introduced)	Secure	Common, Sedentary	Granivore
Estrildidae (Finches)	Painted Finch	Secure	Patchy, Sedentary	Granivore
	Pictorella Mannikin	Near-Threatened	Uncommon, Nomadic	Granivore
	Zebra Finch	Secure	Common, Sedentary	Granivore

Appendix 3: Regional Ecosystem Images

Alluvium open woodland
(R.E.5.3.5)

Sparse Herbland on claypans
(Ephemeral Lake)
These were often inundated after a recent major flood event
(R.E.5.3.22)

Sparse Herbland on claypans
(Ephemeral Lake)
These were often inundated after a recent major flood event
(R.E.5.3.22)

Alluvium tall open shrubland
(R.E.5.3.11)

Interdunal tall open shrubland
(R.E.5.6.2)

Interdunal hummock grassland/Tall open shrubland
(R.E.5.6.6)

Interdunal hummock grassland/Tall open shrubland
(R.E.5.6.6)

Interdunal tall open shrubland
(R.E.5.6.7)

Interdunal tall open shrubland
(R.E.5.6.7)

Ironstone jump-up; low woodland
(R.E.5.7.12)

Undulating country; open shrubland
(R.E.5.9.1)

Undulating country; tussock-grassland
(R.E.5.9.3)

Undulating country' sparse-tussock grassland
(Gibber Plain) **(R.E.5.9.4)**