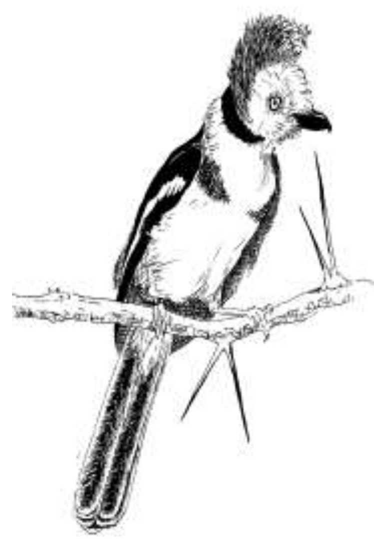
Final Project Report

Expedition to survey the status and threats of Globally-threatened bird species in South Nguruman Important Bird Area, Kenya.



Edited by

George Amutete

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Acknowledgement

This report comprises of the information gathered during the South Nguruman expedition in the period of September 2003 and January 2004. We acknowledge the assistance received from: Staff of Ornithology Department of national Museums of Kenya, Local leaders in South Nguruman, Land Owners, Kenya Wildlife Services for provision of security, Nature Kenya for providing some logistical support. Our greatest thanks go to BP Conservation Program for both funding the project and providing funds and training the students leader in America. All the above have contributed to successful completion of the expedition.

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Background information:

Introduction

What is an IBA?

IBAs are sites of global biodiversity conservation importance that are chosen using internationally agreed, objective, quantitative and scientifically defensible criteria. IBA's are selected because they hold bird species that are threatened with extinction, have highly restricted distributions, or are characteristic of particular biomes. These sites, wherever possible, must be large enough to support self-sustaining populations of those species for which they are important. Sites holding exceptionally large numbers of congregatory birds also qualify. IBAs should also form part of a wider, integrated approach to conservation that embraces sites, species and habitat conservation.

Birds are an important focus for conservation attention in their own right (Diamond and Fillion 1987, Fanshawe and Bennun 1991). They play major roles in the functioning of many ecosystems, particularly trough pollination and seed dispersal. Birds are an important source of revenue through bird watching tourism and sport hunting - both growing activities in Kenya. As elsewhere in the world, birds have great significance in many Kenyan cultures. Birds also provide an excellent means to create awareness of nature and the environment among young people.

As well as their intrinsic importance, birds as a group have many features that make the IBA process a useful shortcut to setting biodiversity conservation priorities:

- They are widespread – birds occur in every habitat in Kenya
- They are diverse, yet there are not so many species that identification becomes a major difficulty
- They are taxonomically well known and stable
- They are relatively large and conspicuous, and mainly active by day, and therefore easily surveyed.
- They have wide popular appeal, so many people have collected useful information on their distribution and status

Although the distribution of threatened or endemic birds may not be entirely congruent with the distribution of, say, similarly important plants or butterflies, the set of sites that contains bird species of concern will effectively conserve other taxa as well

Why is South Nguruman an IBA?

South Nguruman is an IBA because it has globally threatened species (Grey-crested Helmet-shrike, Red-throated Tit, and Jackson's Widowbird), restricted range species (Hunter's Cisticola) and regionally-threatened species (Lammergeier, African Crowned Eagle, Stripped Flufftail and Purple-throated Cuckoo-shrike (Bennun and Njoroge 1999, Birdlife International, 2000). unfortunately this IBA is unprotected

Problem

Information about these species and their conservation status/threats has been lacking. In order to institute any conservation efforts, a thorough avifauna survey was deemed a first and a high priority project of Ornithology Department of National Museums of Kenya and National bird Committee under Nature Kenya

Project Aims /Objectives:

1. to conduct surveys on the types of threats on the habitats of the threatened species present in South Nguruman
2. to establish the composition of avifauna community in the study area
3. train participants (interns and university students) on methodologies of avian surveys.
4. initiate a Site Support Group comprising of the local people to safeguard the threatened species and the general biodiversity of South Nguruman.

Justification

South Nguruman is an Important Bird area in Kenya but unfortunately unprotected. This IBA has three Globally-threatened species (Grey-crested Helmet Shrike, red-throated tit and Jackson's Widowbird, Two restricted-range species and four Regionally-threatened species (Bennun and Njoroge 1999, Birdlife International, 2000). Information about these species and their conservation status has been lacking. A thorough avifauna survey was a high priority project of Ornithology Department of National Museums of Kenya and National bird Committee under Nature Kenya. There was need to initiate local capacity for conservation endeavors for this unprotected Important Bird Area. Given the vast area to be covered and the need students training on field Ecologic methods, university students with diverse ecological background were involved.

Scope and limitations

The study endeavored to cover the entire important bird area of South Nguruman. All the threatened birds status were supposed to be uncovered. This was however limited to some extent by the difficult terrain that made some areas not easily accessible therefore little time was spent in such areas. In addition some areas within the IBA belong to private owners, this further posed a problem of inaccessibility. Due to little data that was gathered during forest vegetation sampling training for the students, this could not be included in the analysis. However in general the bulk of the area was surveyed and significant information gathered.

Methods

Avifauna surveys

Diurnal birds were surveyed as well as nocturnal birds. The nocturnal birds were surveyed between 7 and 11 PM. This involved both road transects and general observations. The road transects were run using a vehicle. All the birds observed or heard were identified and recorded. In the general observations any nocturnal species observed between the same period (7 to 11 PM) were also identified and recorded.

Analysis of bird densities

DISTANCE programme version 3.5 (Laake et al. 1998) was used to calculate the densities of birds. The densities for each study site were then compared suing t-tests

Riverine (Gallery) forest surveys

Both the vegetation and the avifauna in the riverine forest of Entassopia and Oloiborttoto rivers were surveyed. This involved sampling within plots of 20 by 40 meters al the rivers. Along each river a distance of 1 km from the residential areas towards the escarpment was surveyed thus the rivers themselves formed the transect lines. All the birds observed were identified, counted and recorded. The vegetation was sampled by identifying, counting and recording all the tree species in the categories of less than 20cm and greater than 20cm. The landscape parameters were also recorded. These included: - the slope of the cliff bordering the river, the height of the slope, and the width of the riverine forest.

Vegetation survey

Along each transect in the open area where the birds were censused, trees, shrubs and grass plus other vegetation types were identified and quantified. 20 x 20 m quadrants were used as a basic unit for vegetation sampling along these transects. For trees and shrubs: numbers, height (in categories), hedging and percentage canopy cover were recorded. These variables were analyzed using Kruskal-Wallis test that enabled medians of the four samples.

Land use, management and myths attached to South Nguruman

The land use and management practices were recorded from observations made and also interviews with the local people. The later method was used to gather information about the conservation ethics attached to South Nguruman. In order to gather the conservation ethics universally applied and which emanates from common cultural beliefs, it was essential to organize group interviews for the local people with the help of the Site Support Group members. Using the later method ethno-ornithological study was also carried out in order to understand the cultural beliefs and values attached to birds. Ethno-ornithology is perhaps the most suitable tool to start bird conservation education in this remote area. This is with an assumption, like any other community, the Maasais will readily impress the conservation education that takes into account their own cultural values.

Individual / Group projects for the students

In order to develop the students' skills and knowledge, it was deemed necessary that they be assigned projects within the IBA. These projects were done outside the routine work timetable and little supervision was given by the supervisors after giving detailed instructions on the methodologies to be used. This was important to give the students hands-on training.

Similarity analysis

Renkonen Index (RI) or percentage similarity was used to test for similarity in avifauna between pairs of study sites.

$P = \sum_I \text{minimum} (p_{1i}, p_{2i})$

Where P = Percentage similarity between sample 1 and 2

p_{1i}, = percentage species *i* in the community sample 1

p_{2i} = percentage species *i* in the community sample

Diversity analysis

Bird species diversity in each site calculated using Shannon's diversity index **H'**:

$H' = \sum_{I=1}^{S} (p_i)(\log_2 p_i)$

Where H' = index of specie diversity

S = number of species

P_i = proportion of total sample belonging to *i*th species

Evenness

Evenness, (Smith and Wilson 1996) was used. This is independent of species richness and is sensitive to both rare and common species. However as a practice to the students, the other types of similarity indices were calculated as well. In Smith and Wilson (1996) method means of species richness and abundance in the paired sites were compared between areas with different land use that served as or study sites:

Results

Similarity matrix for birds

Similarity matrix for the bird species observed at the four study sites

Similarity Matrix

	Congo	*Conservation*	*Entasopia*	*Olebortoto*
Congo	100	9.8	52.6	9.8
Conservation	9.8	100	24	11.1
Entasopia	52.6	24.4	100	15.5
Olebortoto	9.8	11.1	15.5	100

The percentage similarities between pairs of study sites were generally low with Congo and Oloibortoto being the least similar. None of the pairs showed more than 55% similarity. Bird compositions between all different sites in South Nguruman IBA are widely different.

Riverine survey analysis

Correlation matrix for distance along the river upstream away from residential area, bird feeding guild abundances and habitat aspect variables

	River	**Raptors**	**frugivores**	**seed eaters**	**slope angle**	**ht of slope**	**width of forest**
River dist	1.00	0.64	-0.93	-0.92	0.84	0.86	-0.88
Raptors	0.64	1.00	-0.74	-0.79	0.36	0.36	-0.41
frugivores	-0.93	-0.74	1.00	0.85	-0.76	-0.75	0.83
seed eaters	-0.92	-0.79	0.85	1.00	-0.66	-0.75	0.70
slope angle	0.84	0.36	-0.76	-0.66	1.00	0.89	-0.80
ht of slope	0.86	0.36	-0.75	-0.75	0.89	1.00	-0.73

width of forest	-0.88	-0.41	0.83	0.70	-0.80	-0.73	1.00

As the distance increases the raptors increase and the frugivores decrease, thus different guild show different responses to habitat change.

Bird diversity, densities and evenness measure results

Measure	*Congo*	*Conserv*	*Entasopia*	*Olebortoto*
Simpson's diversity (1-d)	0.906	0.904	0.923	0.72
Reciprocal of Simpson's diversity (1/d)	10.2	9.639	12.7	3.577
Shannon-wiener diversity (h')	4.034	3.781	4.517	3.183
No. of equally common species (n(1)	16.39	14.61	22.89	9.08
Bird Densities	58	46	50	37
Evenness measures -				
Simpson (1/d) measure	0.291	0.357	0.199	0.078
Camargo e-prime measure	0.371	0.429	0.288	0.244
Smith and Wilson evar measure	0.428	0.507	0.304	0.463
Modified nee et al. e(q) measure	0.151	0.18	0.127	0.143

Shannon diversity indices differed significantly (t = 14.9, df = 3, p = 0.0006) between the sites. The difference between the bird densities between the four study sites was significant (t = 4.8, df = 3, p =0.017). Smith and Wilson indices also differed significantly (t = 9.8, df = 3, p < 0.002) between the study sites with different land use.

Range condition for study sites. The scale is 0-3 corresponds to good- bad range conditions.

Site	Soil erosion	Animal trails	Soil crusting	Litter cover	Tree hedging	Life forms	R. Condi
Congo	0.9	1	1	1.1	1.1	1	1
Conservation	1.4	2.2	1.7	1	1.9	1.7	1.7
Entasopia	1	2	1	1	1.2	1.2	1.2

Olebortoto	2.6	2.5	2.6	2.4	2.3	2.7	2.5

The range conditions in the four study sites were significantly ($t = 4.79$, $df = 3$, $p = 0.017$) different. However the average range condition was not alarmingly high (mean =1.6).

Regression of bird variables versus bird density shows that Bird density is significantly (adj $r^2 = 0.890$, $F = 27.3$, $df = 3$, $p < 0.034$) predicted by range conditions

Analysis of vegetation variable

Kruskal-Wallis test results for vegetation variables in the 4 study sites in South Nguruman. Only those variables that differed significantly are listed here.

Vegetation variable	Chi-square	df	p
% cover 0-1m trees	8.1	2	0.0172
No. 1-3m trees	13.3	2	0.0013
% cover 1-3m trees	15.6	2	0.0004
% Shrub cover	8.9	2	0.0118
% Grass cover	13	2	0.0015
% litre cover	6.8	2	0.0327

A reasonable number of important vegetation structural attributes differed significantly between the sites with different land use and management practices

Ringing Results

Bird species ringed at three localities in Nguruman IBA.

Site	*Scientific name*	Category .	Number
congo	*Turtur chalcospilos*	f	2

congo	*Centropus superciliosus*	s	1
congo	*Caprimulgus clarus*	s	1
congo	*Colius striatus*	s	4
congo	*Alcedo cristata*	s	1
congo	*Dendropicos fuscescens*	s	1
congo	*Pycnonotus barbatus*	f	7
congo	*Cossypha heuglini*	s	1
congo	*Cichladusa guttata*	s	1
congo	*Cisticola galactotes*	s	1
congo	*Prinia subflava*	f	1
congo	*Camaroptera brachyura*	f	1
congo	*Zesterops senegalensis*	F	52
congo	*Terpsiphone viridis*	f	1
congo	*Laniarius funebris*	s	2
congo	*Ploceus ocularis*	s	1
congo	*Ploceus xanthops*	s	6
congo	*Ploceus velatus*	s	5
congo	*Ploceus rubiginosus*	s	3
congo	*Euplectes ardens*	s	6
congo	*Lagonosticta senegala*	s	1
Oloibortoto.	*Streptopelia senegalensis*	s	1
Oloibortoto.	*Caprimulgus clarus*	s	1
Oloibortoto.	*Colius striatus*	s	1
Oloibortoto.	*Halcyon leucocephala*	s	2
Oloibortoto.	*Alcedo cristata*	s	1
Oloibortoto.	*Ceryle rudis*	s	1
Oloibortoto.	*Motacilla clara*	F	1
Oloibortoto.	*Andropadus latirostris*	F	1
Oloibortoto.	*Phyllastephus strepitans*	FF	3
Oloibortoto.	*Chlorocichla flaviventris*	FF	3
Oloibortoto.	*Pycnonotus barbatus*	f	3
Oloibortoto.	*Cichladusa guttata*	s	1
Oloibortoto.	*Cisticola cinereolus*	s	1
Oloibortoto.	*Prinia subflava*	f	1
Oloibortoto.	*Camaroptera brachyura*	f	3

Oloibortoto.	*Zesterops senegalensis*	F	9
Oloibortoto.	*Terpsiphone viridis*	f	1
Oloibortoto.	*Nilaus afer*	s	1
Oloibortoto.	*Nectarinia nectarinioides*	s	1
Oloibortoto.	*Ploceus ocularis*	s	1
Oloibortoto.	*Ploceus xanthops*	s	1
Oloibortoto.	*Ploceus velatus*	s	1
Oloibortoto.	*Ploceus rubiginosus*	s	2
Oloibortoto.	*Pytilia melba*	s	1
Oloibortoto.	*Lagonosticta senegala*	s	2
Entasopia	*Dryoscopus culba*	F	1
Entasopia	*Ploceus nigricolis*	f	1
Entasopia	*Anthreptes collaris*	F	1
Entasopia	*Dicrurus adsimilis*	f	1
Entasopia	*Turtur chalcospilos*	f	1
Entasopia	*Indicator minor*	F	1
Entasopia	*Alcedo cristata*	s	1
Entasopia	*Ispidina picta*	W	1
Entasopia	*Euplectes ardens*	s	1
Entasopia	*Cossypha heuglini*	s	1
Entasopia	*Pycnonotus barbatus*	f	2
Entasopia	*Phyllastephus strepitans*	F	4

Simple analysis for forest dependence score

	Number of species		
	Congo	*Olo*	*Enta*
FF	*0*	*2*	*0*
F	*1*	*3*	*4*
f	*5*	*4*	*4*
s	*15*	*15*	*3*
w	*0*	*1*	*1*
	Points for forest dependence		
FF = 5	0	10	0
F = 4	4	12	16
f = 3	15	12	12
s = 2	30	30	6
w = 1	0	1	1
Total	49	65	35

These analysis results show the three sites were significantly different (χ = 9.07, df =2, p < 0.01) and Oloibortoto ranked highest in forest species while Entasopia ranked worst. While this results may slighty underestimate the Entasopia in terms of forest species because less effort was put there, they never the less reflects the in other two sites because equal effort was put there.

Species List of the birds observed at South Nguruman.

Scientific name	Status	Movement	Congo	Conservation	Entasopia	Oloibortoto
1 Struthio camelus	c	R		√		
2 Bubulcus ibis	c	Lm		√		
3 Ardea cinerea	c	am,pm			√	
4 Ardea melanocephala	c	R	√		√	√
5 Scopus umbretta	c	R	√		√	√
6 Threskiornis aethiopicus	c	R	√		√	
7 Bostrychia hagedash	c	R	√		√	
8 Alopochen aegyptiacus	c	R	√			

9	Anas sparsa	fc	R			√	√
10	Sagittarius serpentarius	c	R		√		
11	Macheiramphus alcinus	newr	R	√			
12	Elanus caeruleus	c	R		√		
13	Gyps africanus	c	R		√		
14	Torgos tracheliotus	c	R		√		
15	Circaetus pectoralis	fc	R		√		
16	Circaetus cinereus	fc	R		√		
17	Terathopius ecaudatus	fc	R		√		
18	Polyboroides typus	c	R	√		√	
19	Micronisus gabar	fc	R		√		
20	Melierax poliopterus	fc	R		√		
21	Accipiter tachiro	fc	R		√		
22	Accipiter badius	fc	R	√		√	
23	Accipiter minullus	r	R	√			
24	Accipiter melanoleucos	fc	R		√		
25	Buteo augur	c	R	√			√
26	Haliaeetus vocifer	fc	R	√			
27	Aquila rapax	fc	R		√		
28	Hieraaetus spilogaster	fc	R	√	√		
29	Lophaetus occipitalis	c	R		√	√	
30	Polemaetus bellicosus	r	R		√		
31	Falco biarmicus	r	R			√	
32	Falco peregrinus	r	pm			√	
33	Falco tinnunculus	fc	pm			√	
34	Coturnix delegorguei	fc	am		√		
35	Francolinus sephaena	c	R		√		
36	Francolinus squamatus	fc	R		√		
37	Francolinus leucoscepus	c	R		√		
38	Numida meleagris	c	R		√		
39	Amaurornis flavirostra	fc	R	√			√
40	Balearica regulorum	r	R	√			
41	Neotis denhami	newr	R		√		
42	Otis kori	c	R		√		
43	Eupodotis ruficrista	r	R		√		

44	Eupodotis senegalensis	r	R		√		
45	Burhinus capensis	r	R		√		
46	Rhinoptilus cinctus	r	R		√		
47	Tringa glareola	r	pm				√
48	Pterocles decoratus	c	R		√		
49	Treron calva	fc	R			√	√
50	Turtur chalcospilos	c	R		√	√	√
51	Oena capensis	c	R			√	
52	Columba delegorguei	newr	Lm			√	√
53	Columba guinea	fc	R	√		√	√
54	Columba livia	fc	R			√	√
55	Streptopelia semitorquata	fc	R	√	√	√	√
56	Streptopelia decipiens	c	R		√	√	√
57	Streptopelia capicola	c	R			√	
58	Streptopelia senegalensis	c	R	√	√	√	√
59	Poicephalus gulielmi	newr	R		√		
60	Poicephalus meyeri	newr	R		√		
61	Poicephalus rufiventris	newr	R		√		
62	Tauraco fischeri	newr	R		√	√	√
63	Corythaixoides leucogaster	c	R	√	√	√	√
64	Cuculus solitarius	fc	LM	√	√	√	√
65	Chrysococcyx caprius	fc	R		√	√	√
66	Centropus superciliosus	fc	R	√	√	√	√
67	Bubo lacteus	fc	R	√			
68	Glaucidium perlatum	r	R		√		
69	Caprimulqus clarus	fc	R	√			
70	Cypsiurus parvus	newr	R			√	
71	Apus barbatus	newr	R			√	
72	Apus niansae	fc	R			√	
73	Apus aequatorialis	fc	R	√		√	
74	Apus caffer	fc	R	√	√	√	
75	Apus affinis	fc	R	√	√	√	√
76	Colius striatus	c	R	√	√	√	√
77	Urocolius macrourus	c	R		√	√	
78	Apaloderma narina	r	Lm				√

79	Halcyon leucocephala	c	R	√	√	√	
80	Halcyon senegalensis	c	R		√	√	√
81	Halcyon chelicuti	fc	R		√		
82	Alcedo cristata	c	R	√		√	√
83	Ispidina picta	fc	Lm	√	√	√	
84	Ceryle maxima	r	R				√
85	Ceryle rudis	c	R			√	√
86	Merops apiaster	fc	Pm	√	√	√	√
87	Merops bullockoides	fc	R		√		
88	Merops pusillus	fc	R		√		
89	Coracias caudata	c	am		√		
90	Upupa epops	c	am,pm	√	√		
91	Phoeniculus purpureus	c	R		√		√
92	Rhinopomastus cyanomelas	c	R		√		
93	Rhinopomastus minor	fc	R		√		
94	Tockus erythrorhynchus	c	R		√	√	√
95	Tockus deckeni	c	R		√		
96	Tockus jacksoni	c	R		√		
97	Tockus alboterminatus	fc	R	√		√	√
98	Tockus nasutus	c	R	√	√	√	√
99	Pogoniulus bilineatus	newr	R	√		√	√
100	Pogoniulus pusillus	fc	R		√		
101	Tricholaema diadematus	fc	R		√		
102	Tricholaema lacrymosus	fc	R	√		√	√
103	Tricholaema melanocephalus	r	R		√		
104	Lybius leucocephalus	fc	R	√			
105	Trachylaemus erythrocephalus	fc	R		√	√	
106	Trachylaemus darnaudii	fc	R		√		
107	Indicator variegatus	fc	R		√		
108	Indicator indicator	fc	R		√		
109	Indicator minor	fc	R		√		
110	Campethera nubica	c	R	√	√		
111	Denropicos fuscescens	c	R	√	√		
112	Thripias namaquus	fc	R		√		
113	Mesopicos goertae	c	R		√	√	

114	Mirafra albicauda	fc	R		√		
115	Calandrilla cinerea	fc	R		√		
116	Eremopterix leucopareia	c	R		√		
117	Riparia cincta	fc	R		√		
118	Riparia paludicola	r	R		√		
119	Hirundo smithii	fc	R		√		
120	Hirundo rustica	fc	Pm	√	√	√	√
121	Hirundo daurica	fc	R		√	√	√
122	Hirundo abyssinica	c	R		√	√	√
123	Hirundo fuligula	c	R	√	√	√	√
124	Psalidoprocne holomelas	c	R		√		
125	Motacilla aguimp	c	R			√	√
126	Motacilla clara	fc	R	√			√
127	Motacilla flava	r	Pm	√	√		
128	Anthus cinnamomeus	c	R		√		
129	Macronyx croceus	r	R		√		
130	Andropadus latirostris	fc	R				√
131	Phyllastrephus strepitans	fc	R			√	√
132	Chlorocichla flaviventris	fc	R				√
133	Pycnonotus barbatus	fc	R	√	√	√	√
134	Turdoides jardineii	r	R			√	√
135	Turdoides rubiginosus	c	R			√	√
136	Pogonocichla stellata	newr	R				√
137	Cossypha natalensis	newr	am			√	
138	Cossypha heuglini	fc	R	√		√	√
139	Cichladusa guttata	c	R	√		√	√
140	Cercotrichas leucophrys	c	R		√	√	
141	Cercotrichas quadrivirgata	c	Lm		√		
142	Oenanthe oenanthe	c	PM		√		√
143	Oenanthe isabellina	c	PM		√		
144	Thamnolaea cinnamomeiventris	c	R				√
145	Turdus olivaceus	newr	R	√			
146	Muscicapa adusta	fc	R		√		
147	Melaenornis fischeri	fc	R	√	√	√	√
148	Melaenornis pammelaina	fc	R			√	√

149	Bradornis microrhynchus	fc	R	√	√	√	√
150	Empidornis semipartitus	fc	R		√		
151	Acrocephalus schoenobaenus	newr	Pm			√	
152	Phylloscopus trochilus	r	Pm	√	√	√	√
153	Cisticola nanus	r	R		√		
154	Cisticola galactotes	fc	R	√	√	√	√
155	Cisticola chiniana	fc	R		√	√	
156	Cisticola cinereolus	fc	R		√		
157	Cisticola brunnescens	newr	R		√		
158	Cisticola ayresii	newr	R		√		
159	Prinia subflava	c	R	√	√	√	√
160	Calamonastes simplex	c	R		√	√	
161	Camaroptera brachyura	c	R	√	√	√	√
162	Apalis flavida	c	R	√	√	√	√
163	A.alticola	newr	R				√
164	Sylvietta whytii	fc	R		√	√	√
165	Eremomela icteropygialis	fc	R		√		
166	Phyllolais pulchella	r	R			√	
167	Parisoma lugens	r	R	√		√	√
168	Zosterops senegalensis	c	R	√		√	√
169	Parus albiventris	fc	R	√		√	√
170	Parus fringillinus	r	R		√		√
171	Terpsiphone viridis	c	am	√	√	√	√
172	Prionops plumatus poliolophus	fc	R			√	√
173	Eurocephalus rueppelli	c	R	√	√	√	
174	Lanius dorsalis	c	R	√	√	√	√
175	Nilaus afer	fc	R		√	√	√
176	Tchagra australis	fc	R			√	√
177	Malaconotus sulfureopectus	fc	R		√	√	
178	Malaconotus blanchoti	fc	R		√		
179	Rhodophoneus cruentus	fc	R		√		
180	Laniarius aethiopicus	c	R	√		√	√
181	Laniarius funebris	c	R	√	√	√	√
182	Dryoscopus cubla	c	R	√		√	√
183	Campephaga flava	fc	R			√	

184	Dicrurus adsimilis	c	R	√	√	√	√
185	Oriolus auratus	fc	Am			√	
186	Oriolus larvatus	fc	R	√	√	√	√
187	Corvus albus	fc	R	√		√	√
188	Corvus albicollis	r	R			√	√
189	Corvus rhipidurus	r	R		√	√	
190	Onychognathus morio	fc	R			√	√
191	Lamprotornis purpuropterus	r	R	√	√	√	√
192	Lamprotornis hildebrandti	fc	R		√		
193	Lamprotornis superbus	c	R	√	√	√	√
194	Cinnyricinclus leucogaster	fc	am			√	
195	Creatophora cinerea	fc	am		√	√	
196	Buphagus erythrorhynchus	fc	R		√		
197	Anthreptes orientalis	fc	R		√		
198	Anthreptes collaris	fc	R	√	√	√	
199	Nectarinia amethystina	fc	R			√	√
200	Nectarinia senegalensis	fc	R	√	√	√	√
201	Nectarinia hunteri	fc	R				√
202	Nectarinia venusta	fc	R	√	√	√	√
203	Nectarinia nectarinioides	fc	R	√	√	√	√
204	Passer domesticus	c	R	√		√	√
205	Passer motitensis	c	R	√		√	√
206	Passer griseus	c	R	√	√	√	√
207	Passer eminibey	c	R		√	√	
208	Petronia pyrgita	c	R		√	√	
209	Plocepasser mahali	c	R	√	√	√	√
210	Pseudonigrita arnaudi	c	R	√	√	√	√
211	Amblyospiza albifrons	fc	R			√	√
212	Ploceus ocularis	c	R	√	√		√
213	Ploceus melanogaster	r	R		√		
214	Ploceus xanthops	fc	R	√		√	√
215	Ploceus velatus	c	R		√		
216	Ploceus intermedius	fc	R		√		
217	Ploceus cucullatus	fc	R		√	√	√
218	Ploceus rubiginosus	c	R	√	√	√	√

219 Anaplectes rubriceps	fc	R		√		
220 Quelea quelea	c	am		√	√	√
221 Euplectes albonotatus	fc	R	√	√	√	√
222 Euplectes ardens	c	R	√	√	√	√
223 Euplectes Jacksoni	fc	R	√			
224 Pytilia melba	c	R	√	√	√	√
225 Lagonosticta senegala	fc	R	√	√	√	√
226 Estrilda rhodopyga	fc	R		√	√	
227 Estrilda astrild	c	R	√	√	√	√
228 Uraeginthus bengalus	c	R		√	√	√
229 Uraeginthus cyanocephalus	c	R		√		
230 Uraeginthus ianthinogaster	c	R	√	√	√	√
231 Lonchura griseicapilla	fc	R		√		
232 Lonchura cucullata	fc	R	√	√	√	√
233 Lonchura bicolor	fc	R	√			
234 Vidua macroura	fc	R		√		
235 Serinus citrinelloides	c	R	√			√
236 Serinus dorsostriatus	fc	R		√		
237 Serinus sulphuratus	fc	R		√		
238 Serinus striolatus	c	R		√		
239 Serinus reichenowi	fc	R		√		
240 Emberiza flaviventris	r	R		√		√

Key:
newr – new for the area atlas square Species for which the Ornithological subcommittee would be pleased to receive all records for publication in the annual East African bird report.
C – common
Fr- fairly common
R - rare
B - Fewer than 50 records in Kenya .
R - Resident
Am - Afrotropical Migrant
am , pm - migrants of that category occur alongside resident or non-migratory individuals
Key continued
Lm - Local movement

New species for the Kenya Bird Atlas

This expedition provided some information on the distribution of some species in Kenya. Some species had hitherto been thought not to exist in South Ngururman. The following are new species for the atlas square for South Nguruman.

Two hundreds and forty species were seen during this survey and they included residents and migrants. South Nguruman is not only important for threatened birds but also for migrants of which every nation of the world has a protection responsibility.

Discussion

Similarity

Overall all the samples from all the areas showed little similarity in species composition. Only Entasopia and Congo samples lightly over 50% similarity while all the rest of binary similarities were less that 30%. The implication is that each kind of habitat support bird community significantly different from the others. This dissimilarities could be because different birds select different habitats. Therefore to have conservation of a greater diversity of birds all the habitats studied need to be conserved. Thus each habitat is important.

The community through group ranch have endeavored to have conservation are at Shombole. There are plans for Olepototo and Entasopia to team up and have conservation area similar to that of Shombole. This is an effort but would be worthy one if such is enacted with a defensible researched information on the choice of the area to be conserved. Before this action is undertaken in south, it would be wise to have PRA done followed by community conservation action plan. This will be a sure way of having effective conservation that is supported by the local community and for their benefit.

Diversity

The values of diversity are fairly high for each site. Value of H' =5 means the diversity is high. However the diversities are significantly different meaning that the land use type and management systems affect the bird diversity. Land use and management systems practices need to be harmonized to safeguard and conserve biodiversity element, birds included. For the South Nguruman it is worth to conserve as much of the IBA as possible in order to maximize the overall bird diversity.

Evenness

Evenness value of one means the birds are evenly distribute within their habitat. The values of studied sites indicate birds are not evenly distributed within each habitat. This implies that the habitats within different land use sites are not uniform but heterogeneous. Birds select different habitats therefore the more they are the better. It is therefore more profitable to conserve heterogeneous habitat. The significant differences between evenness at different sites means that land use and management systems too affect evenness of bird distribution and therefore urgent attention needs to be given to this systems practices.

Bird densities and range conditions

Overall bird densities per hectare were high for South Nguruman. These densities however differed significantly between the sites studied. This is as a result of land use and management practices that affect the range conditions. Range conditions have a direct impact on vegetation structure to which birds respond. Overall bird densities for all sites were significantly predicted by the corresponding range conditions. Intensity of land use, as is manifested in range conditions, need be regulated to favor reasonable and acceptable bird densities.

Vegetation surveys

The vegetation structural variables differed significantly between the site because of the disturbance levels. Different land use and management practices affect differently the vegetation. These practices in turn affect the other biodiversity element including birds. There is need for such practices to be made conservation friendly to ensure long term sustainable use of the resources within habitats of South Nguruman.

Riverine surveys

Different guilds have different habitat selection along the river course. Conserving the entire river course is conserving greater diversity of bird species. This is because the rivers course supports the suitable habitats for a variety of birds.

Forest dependence for the ringed birds

Different sites supported varied levels of understorey forest dependant birds. This could have been due different vegetation structural attributes that exist in the different sites.

New birds for the Kenya Bird Atlas Square of South Nguruman

The records are going through vetting process for the National Bird Committee at which the supervisors of the project are members. Upon validation the records will become official and can be incorporated in the publications.

Information on selected threatened birds observed

Grey-crested Helmet-shrike *Prionops poliolophus*

A social group-living species, inhabits open woodland, wooded grassland and bushland of *Acacia/ Tarchonanthus* (1,200-2,200m), in a restricted area of south-west Kenya and adjacent areas of northern Tanzania. This species was on most occasion observed on the slopes of South Nguruman. Groups comprising of an average of six individuals were regularly observed ant Oloibortatoto and Entasopia. Local Massai people could produrce the species king of call when shown the picture of it! Least did they know this is bird of global importance. Observation of the species movement pointed the possibility that it might have an extremely large foraging range when not breeding. Increasing densities of livestock and horticultural cultivation of IBA marginal land are degrading its habitat. Its The population around South Nguruman IBA (Entasopia and Oloibortoto) should be surveyed, as soon as possible, to assess its ecology, habitat requirements, distribution and numbers,

Jackson's widowbird *Euplectes jacksoni*

This species was commonly observed in open grassland and tall grass of Shombole and Pakaze areas. It was also sighted in horticultural areas feeding. This a restricted-range species of the Nguruman hills grasslands is threatened by destruction and fragmentation of this grasslands, as a result of intensified horticultural development and livestock production. Fires, started by pastoralists, to sprout fresh grass, temporarily destroy most suitable habitat.

Other species threatened species

Several threatened species were observed and are indicated on the above species list. The problem is that they face extinction if no conservation measures are instituted.

Additional information gathered during the survey

General information about South Nguruman

Nguruman in Maasai language means a place of much food. This area has a long history of farming. The indigenous people practiced farming which involve growing of crops. The main crops were maize and beans and sweet potatoes for subsistence use. About ten years ago horticultural farming started. This farming type was encouraged by the horticultural products exporters who provided some advise on the methods of this farming and some farm inputs.

Nguruman as a tsetse fly infested area

Nguruman area is highly infested by tsetse flies. This has caused overtime serious problems to the livestock rearing and to some extent human disease. However the indigenous people had methods of treating this maladies using the medicinal plants found in the local environment. However various institutions had been involved in the eradication of these flies. This has been through trapping of the flies which has consequently reduced the problem. In addition these organizations have been providing veterinary services for the livestock. The indigenous people interviewed are very positive about these programs and also agree that these services are effective in improving their productivity. Surprising they understand all the signs of the diseases that affect their livestock and they also agree that the veterinary treatment is just like their indigenous method of treatment but with an advantage. The advantage lies in the fact that the veterinary treatment has a wider application that extent to other breeds that are not indigenous to Nguruman. These services have enabled the indigenous people to accept an introduced breed of cattle known as *Boran*. This breed is fast and effectively replacing the indigenous breed. The indigenous people concur that the *Boran* breed has higher weight and milk. This breed however gets sick easily but responds well to the medicine given by the veterinary personnel. In general this breed has been accepted despite the fact that it was introduced by the whites whose culture has never effectively penetrated in a Maasai culture.

Nguruman people

South Nguruman is inhabited by a number of clans of Maasai people; these are the Pagaze (Lodoklani), Purko, Loitians and Entasekera. The clan that inhabits Olepototo and Entasopia are the ones who practice horticulture. The distribution of the farms is unique. Each farmer takes as much land as possible but what he can farm. There’s no set way of distributing the arable land. Many of the Maasai people who have from time immemorial been practicing pastoralism are now discovering that farming is more profitable than cattle rearing in this area with plenty of water from the Nguruman hills. This is putting a lot of pressure on the limited available arable land that harbor important biodiversity elements.

Myths of the Maasai on the South Nguruman Escarpment

A myth consists of a core of beliefs, rules for conduct, and a variety for symbols. Myths in technical sense are taken for granted by most people who are seldom conscious of underlying premises from which their deliberations and actions spring. The Maasai people hold certain cultural values relating to unique landscape and habitats in South Nguruman. For instance the rocks break and fall with great sounds during certain periods. This is normally associated with an advent of rains. The habitat has also contributed to fertility in a unique way. The respected elders used to take those ladies who have not given birth to the hills and pray as they eat *Olasai* and *Oledeti* tree parts. These were usually accompanied with beer from honey and milk. It is believed that a big snake with hair would appear during this sacrifice and the elderly would sprinkle it with beer and it would disappear again. The ladies would then be able to give birth soon after this kind of sacrifice had been done. *Oranni* or the Maasai warriors also utilized the various aspects of the landscape and the biodiversity elements during their initiation.

Other believes associated to the escarpment were common. For instance *Nanauniri*, a creature with one side like sheep, the other side like stone is believed to exist in the forests within the escarpment. This creature is difficult to see and moves away from people and has its own language and is very sensitive to smell. At times it hurts people who come in conduct with it

Draft paper 1

Some aspects of nest selection in human habituated bird species.

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Introduction

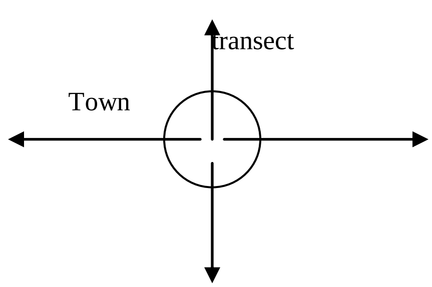
Birds are extremely mobile and wide ranging, and of the range of habitat they pass through or over, only specific ones are used for breeding or foraging or wintering. The proximate stimuli for choice of habitat might be structural features of the landscape, foraging, or presence of other species, or nesting opportunities. When nesting opportunities arise, birds do nest selection. Nest selection involves the specific choice of where to build a nest. This is usually a site within its territory and must maximize on the potential for cover and protection from sun and predators. However, although generally species select specific habitats, they are not inflexibly tied to a specific type of habitat (Cody, 1985).

White Browed Sparrow Weaver is a highly social, noisy an in flocks of 20 or more (Zimmerman et all 1996). This species feeds on ground, at times in mixed flocks on mainly insects and seeds. This species is reasonably tame and often associated with human habitation. The nests for the species of interest, White Browed Sparrow Weaver are large, are untidy retort-shaped structures made of dry straw-like grass and built into the outer branches of trees that have wide spreading branches (e.g. acacia), and clustered on the opposite side of the tree to the direction of the prevailing winds (Tarboton, 2001). The understanding of nest selection in human-modified environments may provide cue for fostering continued human co-existence with the bird species. Perhaps the fundamental question that would help us realize this is "what limits the nest selection for the White Sparrow Weaver?" To answer this question this study investigates the key factors that limit the nest site selection for this species in human settlement area South Nguruman in Rift Valley, Kenya. .

Study area.

South Nguruman is of exceptional conservation importance (Bennun and Njoroge 1999). Understanding how a common species select its breeding habitat provides an effective tool for starting conservation education and advocacy from local communities doorsteps and projecting to the unknown. South Nguruman lies in the western wall of Rift valley and in southernmost Kenya at (01^{0} 50’S, 35^{0} 50’E) about 150km southwest of Nairobi. The scarp rises steeply in a series of stepped, rocky faults from the flood plain of southern Ewaso Ng’iro river on the valley floor at around 900m to some 2300m on the escarpment crest. From here the land falls more gently away to the Loita plains and the Masai Mara (IBA 50). The vegetation changes from *Acacia tortilis* woodland on the plain, to dense *Acacia-commiphora* bush on the lower slopes, to *tarchonanthus* thicket and grassland and finally, sub-montane forest. Two main urban centres (towns) Ngomongo and Entasopia in the middle of South Nguruman were chosen for the study. These towns were 5km apart and with similar and equal human activities.

METHODS



Two towns with high activity were chosen and four transects from the centre of each town were sampled. All transects were straight and 1Km long. Each transect was sampled twice. Along each transect and within 50m on both sides the following parameters were recorded at different points: identity of all trees, nest identification and number on each tree, distance of the tree from the transect, height of the tree, height of lowest and highest nests, diameter of tree crown and the diameter of tree at breast height.

The collected data was normalized for parametric tests. The Spearman's Rank Correlation was used to establish the degree to which the pairs of variables were related. Multiple Regression using STATSOFT, Version 6, was used to determine predictors for bird variable.

Results

It was evident from the data that most of the birds that nested in the two towns were White Browed Sparrow Weaver. The nests for this species were exclusively found on the dominant *Acacia tortilis.* The abundance of *A. tortilis* form 54% of the 14 tree species recorded in the study area (Figure 1). Not all the *tortilis* were nested on, only 45 % of this tree species had White browed Sparrow Weaver present. Practically all (100%) the nests were found on the trees with DBH > 20cm.

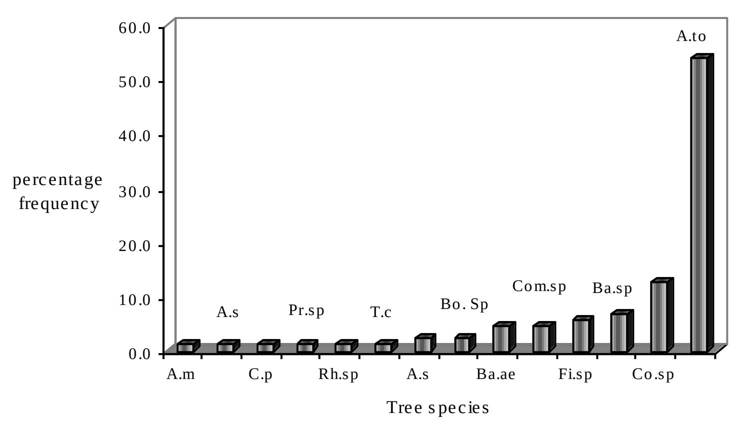


Figure 1: Shows the percentage frequency of the 14 tree species recorded in the study area

Table1: shows the correlation coefficients for various bird and habitat variables

	NO_NEST	DIS__TWN	TRA_DIS	TRE_HT	HT_L_NT	HT_H_NT	NESCRR	CRN_D
NO_NESTS	1							
	p= ---							
DIS__TWN	-0.4761	1						
	p= .022	p= ---						
TRA_DIS	0.1744	0.2635	1					
	p= .426	p= .224	p= ---					
TRE_HT	0.3463	-0.399	-0.2286	1				
	p= .105	p= .059	p= .294	p= ---				
HT_L_NTR	-0.2093	-0.2859	-0.4627	0.4156	1			
	p= .338	p= .186	**p= .026**	**p= .049**	p= ---			
HT_H_NTR	0.2728	-0.4356	-0.2738	0.6274	0.7711	1		
	p= .208	**p= .038**	p= .206	**p= .001**	**p= .000**	p= ---		
NESCRR	0.682	-0.1194	0.3673	0.1662	-0.5606	0.0949	1	
	p= .000	p= .587	p= .085	p= .448	**p= .005**	p= .667	p= ---	
CRN_D	0.3038	-0.2583	0.1612	0.604	0.0045	0.2752	0.351	1
	p= .159	p= .234	p= .463	**p= .002**	p= .984	p= .204	p= .101	p= ---

NESCRR= nest crown range, CRN_D= nest crown diameter

NO_NESTS= number of nests, DIS_TWN = distance from town, TRE_HT = tree height,

Table2: **Regression results**

Dependent Variable	**Predictors**	**adj r^2**	**p**	**t**	**F**
Number of nests	Crown diameter	0.439838	0.028636	2.226351	((1,85))= 4.9566
Number of nests	height of highest nest	0.754148	7.63E-28	16.27278	(91,85)= 264.80
Number of nests	nest crown range	0.569104	1.98E-17	10.70441	(1,85)= 114.48
Number of nests	height of lowest nest	0.567986	2.22E-17	10.68025	(1,85)= 114.07
Number of nests	distance from town	0.042382	0.031092	-2.19229	(1,85)= 4.8061
Tree height	Crown diameter	0.471449	5.40E-19	11.49373	(1,85)= 77.709

It is evident from this data (Table 2) that the nest crown range, distance from town center diameter of the crown, significantly predicts the number of nests. The tree crown diameter was positively correlated with the height of the tree.

Discussion:

White Browed Sparrow Weaver selection of *Acacia tortilis* as the exclusive tree to nest on could be due to co-evolution. For birds, habitat choice is more dependent on prior events than upon immediate conditions (Blondel, 1985). This is reinforced by the fact that the tree species was dominant thus it appears to be better adapted to the prevailing environmental conditions. White Browed Sparrow Weaver was the dominant nesting species in these towns, perhaps perceived by other species as poor environment. This could be density compensation, phenomenon of increased densities per species in species poor situations. White Browed Sparrow Weavers' selection for specific individual trees of the *A. tortilis* species confirmed that not all the trees of this species had the desired attributes that contribute positively to nesting success. Selecting large trees with DBH> 20cm could be the species attempt to maximise on the security, that is, potential for cover and protection from sun and predators. It is, nevertheless, birds have been found to respond to some element of general habitat configuration, but their within-habitat responses may be more strongly associate with details habitat floristics (Weins and Rotenberry, 1981)

As one moves towards town centre the level of human activity increase. This increase can be assumed to be proportional to increase in disturbance level originating from human activities e.g. movements, habitat modification e.g. However the birds appear to adjust rather than be entirely tolerant to these human activities. This could be through the observed adjustment of the height level at which they nest. Such adjustment could through birds' judgemental ability on the opportunity cost for nesting away from the town centre. The fact that the nest number per tree increase as one moves towards town centre confirms that these birds prefer to be associated to human habitation but they take precaution to systematic selection of certain foliage profiles. Indeed this in agreement with Terborgh (1977), that habitat structure or physiognomy is important to bird habitat selection but more specifically the aspect of foliage profiles. In this case the decrease of nesting population as one moves away from the town centre could be due to the fact that as population rises, normally less prised area may be chosen. However it should be appreciated that habitats selection may also vary with spatial scale and likely to change pattern. A shift in vegetation structure and availability of resources may explain a change in foraging and nesting behaviour (Cody 1985)

Understanding of the desired habitat attributes by human habituated birds can foster co-existence of man and these species. This can be effectively realised through raising awareness that promote proactive ecological conservation of such habitat.

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Draft paper2 for students project:

Effects of water points on biodiversity elements in Nguruman IBA

Abstract

Water points provide a nucleus for disturbance. Studying the disturbance gradient as one moves away from the water point may provide some management hints related to spacing this water points. In this study both the range conditions along the increasing distance from water point and the corresponding bird abundances were studied. The birds' abundances were modelled along this gradient. This study shows that a disturbance gradient is established along the distance from water point. Such disturbance affects the habitat quality for birds and is manifested in the changes in their abundances. Understanding such effects of water point and the responses shown by indicators such as birds, can be strong planning and conservation tool.

Introduction

Intensified grazing by livestock is considered to be one of the main threats to the floristic diversity of arid and semi-arid regions worldwide (Middleton and Thomas 1997, Riginos and Hoffman 2003). Certainly, these threats have cascading effects that spread out to the faunal diversity present in these regions. However, more specifically, provision of artificial sources of drinking water has resulted in major landscape conditions transformations. Despite this, there is increasing recognition of the risks that provision of new water may pose to grazing sensitive-biota, however, and a number of studies are being undertaken to investigate strategies of minimizing the negative impacts on biodiversity (Hunt *et al*. 2003). Indeed little is known about the mechanism by which grazing impacts the population dynamics plant community characteristic of rangelands (Milton and Dean 1995, Milton, Davies and Kerley 1999)

But reasonably, the mechanism may lie in intensified and consistent deterioration of range conditions that suppress vegetation composition diversification and subsequently other biodiversity aspects they support. Indeed research shows that, grazing may have a negative impact on rangeland plants through the following mechanisms by reducing the competitive ability of the grazed relative the ungrazed, less unpalatable (Milton, Gourlay and Dean 19997; Assaeed and Aldoss 2001) (ii) by reducing the reproductive output of the grazed individual (stocks 1994) or (iii) by reducing the success of seed establishment (Hunt 2001)

Study Area

Water points within South Nguruman IBA

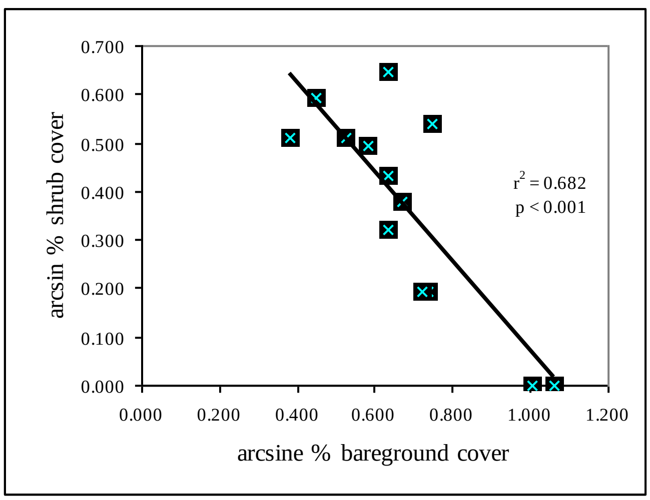
Study Methods

We chose distance from the water point as a surrogate for long term grazing because of its reliability and generalizability (Pickup, Bastin and Chewings 1994). Grazing gradients created by waterholes were therefore deemed suitable to examine the impacts of grazing on range conditions and vegetation composition. We then modelled the bird numbers along these gradients.

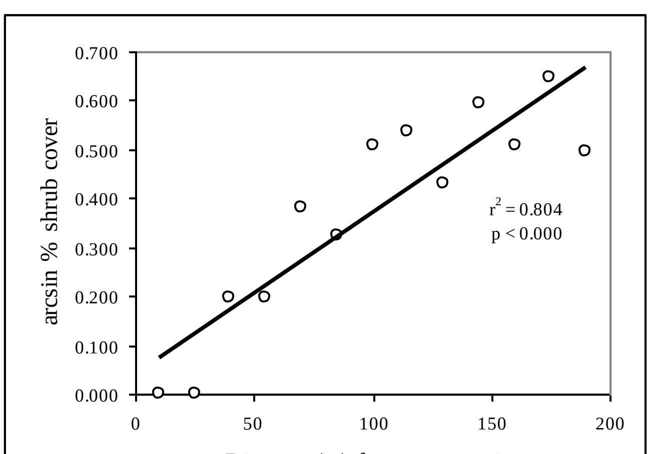
Results

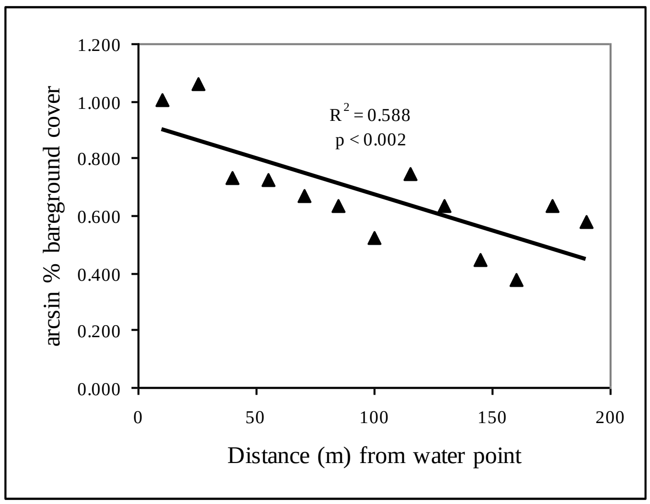
Correlation between the various variable are shown below.

significantly correlated variables	*Valid*	*Spearman*	*t(N-2)*	*p-level*
Distance from water point and shrubs cover	13	0.8497	5.3440	0.0002
Distance from water point and bareground cover	13	-0.7680	-3.9767	0.0022
Bareground cover and shrub cover	13	-0.7680	-3.9767	0.0022

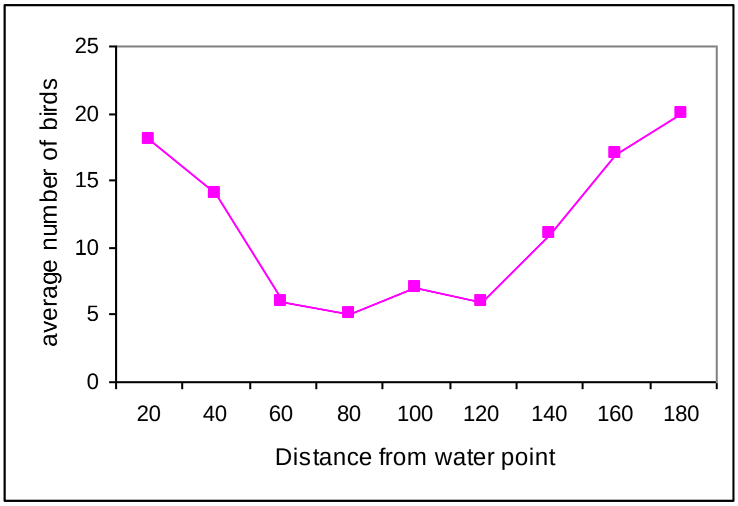


The was inverse but significant relationship between percentage shrub cover and the percentage bare ground cover





As the distance from the water point increased the bared ground cover decreased, thus the disturbance decreased with increasing distance from the water point



The average bird abundances along the radial transects vary with the distance from the water point. After 120m the average number of bird increased unlike to less distance from the water point

Regression results:

Regression results for water point at distance up to 80m				
Average % Shrub	Average % bare ground	Average % litter	Average % Grass	Distance from water point
Adj. r^2 = 0.892	0.789	0.656	0.748	0.895
F (1,2) = 25.9	12.2	3.83	9.9	26.6
P < 0.36	0.7	0.189	0.08	0.035
Regression results for water point at distance 80m-200m				
Adj. r^2 = 0.154	-0.252	-0.160	-0.237	0.877
F (1,2) = 1.72	0.197	0.57	0.23	29.5
P < 0.28	0.69	0.50	0.66	0.012

Bird abundances respond can be predicted by some elements of vegetation structure and also the distance from the centre of disturbance.

Discussion

The statistical values may probably be with experimental errors, none the less they give some indication of the scale of potential threat, if development of new water sources proceeds without incorporating specific measures to safeguard biodiversity. This study confirms what land managers have long suspected: that those areas remote from water and associated grazing are valuable for plant diversity (Noy-Meir 1996).

Many mangers may be receptive to the idea of retaining some of their water-remote areas as refuges for sustained grazing. Selective reduction in the number of artificial water sources in more developed regions offers prospects as strategic tool for improving the status of those species negatively affected by water-cantered activities and other grazing animals.

Conclusion

In rangelands, water points support concomitant increases in cumulative grazing pressure (Landberg et al 2003). By spreading grazing pressure more evenly across the landscape, localised degradation around existing water points is reduced. Also by expanding the area of grazing land accessible to livestock, greater numbers of stock can be produced without any increase in average stocking pressure (Landsberg et al 2003). This can be effectively achieved by evenly distributing the water points within the Nguruman ranches to minimize or alleviate their negative impacts on other biodiversity aspects. The water points which may have the surrounding habitats badly damaged should periodically be relieved of all their grazing pressure to allow for successful re-establishment of native vegetation.

Overview of the Project:

Achievements

Public awareness:

The local leaders were briefed on the importance of the work being done at the site and how this site is important not only to the local but also the wider communities and the world.

Site Support Group

The site support group was formed with an aim of spearheading conservation efforts at the site. It is intedent that this group be recommended to Nature Kenya that will boost their function in the public awareness and advocacy.

Training of the local

Addition to technical assistance through special training from Ornithology Department of National Museum of Kenya is planned for at least two SSG.

Local community Bird Checklist

With the help from team members from the Maasai community, some local and English language checklist has been made and is preparation. This willl be supplement the site support group's efforts to create awareness among the local people and the wider community around the study site.

Education outreach

During the training sessions, the site support group were advised on how to get information disseminated to the local schools and get students (especially wildlife/science clubs) to fully participate in increasing awareness and eventual conservation process of this IBA.

Publications

Awareness articles in popular magazines and scientific papers are at an advanced stage (see below for instance) this will enhance public awareness and stake holding government departments in addition to non-governmental organizations. The sample paper below will supplement main papers from the project which which based on the baseline data provided.

Output and conservation action likely to be achieved, post project

The local field guides/assistants who were chosen with the help of the site intern and local community leaders. This team now forms the core members of the site support group ready to play significant role conservation endeavored and decisions that appertain to this. This group was established on the basis and strength of the knowledge and training acquired from the project.

Information for the Kenya Bird Atlas on new species is available for updating the distribution of these species in South Nguruman Atlas Square. This information also affects the distribution of these species in Kenya and has an impact on the published information that now needs updating.

Recommendations:

Globally threatened birds exist in South Nguruman but under intensified human pressure on this unprotected IBA. Integrated approach for conserving the threatened unprotected IBA is urgently required. This must involve proper application of researched knowledge specific to South Nguruman area. To achieve this, focus should be on supporting community-based adaptive habitat management for sustainable conservation of biodiversity. This scheme can only be realized by setting appropriate objectives that address the need of investigating and initiating strategies on how to conserve and manage the existing biodiversity elements of South Nguruman, the unprotected Important Bird Area for the benefit of local communities and landowners. The objectives could be; involve the local community and make a comprehensive inventory of biodiversity elements; make some specific socio-economic studies; study the ecology of the threatened species and educate the locals and SSG how their habitat requirents and institute monitoring programmes; map out land uses and recommend limits to be safeguarded by the local communities; investigate and initiate alternative source and opportunities of income generation such as eco-tourism while boosting the existing conservation friendly ones ones; Carry out Participatory Rural Appraisal (PRA) aimed at creating and enacting community-based conservation action plans; seek deeper and accurate understanding of the biodiversity elements of South Nguruman. The integrated approach highlighted above is urgent and critical for effective conservation of the unprotected Soutth Nguruman IBA. This approach can be realized if the team that has the baseline information is supported to address the above issues as it has firm goodwill and trust from the local community. In addition the detailed study of the ecology of the threatened species is likely to be realised better if one of the students who participated on this expedition project does this for Master of Science study under the supervision of the Ornithology Department.