

Avifaunal Surveys of Hilltop forests in the semi-arid areas of Kitui and Mwingi Districts, Eastern Kenya.

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KEY PROJECT OUTPUTS/MILE STONES

1. Involvement of local community members as field assistants enhanced capacity building, created awareness on the conservation of birds/biodiversity and generated some income through the wages they earned as field assistants. Exposure to use of binoculars and bird ringing. I assessed the existing local community groups as potential Site Support Groups (SSG) as they are termed in the Important Bird Areas framework.
2. The project offered a learning opportunity for two graduate interns in the Ornithology Department of National Museums of Kenya. They gained skills in bird survey methods and ringing and use of various equipments.
3. The project has led to immense filling up of knowledge gaps in this area, many birds were not known to occur in this area. Since survey has documented 5 Globally threatened bird species, discussions are under way to recognize as the area as an Important Bird Area (IBA). This is through BirdLife International and National Partner Nature Kenya.
4. For future monitoring a total of 363 individual birds in 35 species were ringed. These include resident, Afro-tropical and Palaearctic migratory species.
5. This project interaction with other projects in the area being executed by other institutional in collaboration with the local communities e.g. Bee keeping/Honey processing, Silk Worm rearing, Biodiversity monitoring, Horticulture & Woodlot nurseries, etc
6. Overall the project was a good supplement for the previous rapid assessment funded by Research Programme on Sustainable Use of Dryland Biodiversity (RPSUD).
7. With leveraged support from RPSUD and National Museums of Kenya, we held workshops/seminar for disseminating our findings and feed back to the local community, officers of the government agencies managing the forests and surroundings i.e. Kenya Forest Service (KFS), National Environment Management Authority (NEMA), Kenya Wildlife Service (KWS). Full reports have also been shared widely among various stakeholders.
8. A scientific paper based on this work has been send to 'SCOPUS' the journal of East African Ornithology.
9. The project was a great success but farther work is needed to establish the IBA boundaries based on the range of occurrence of the globally threatened species and publicising the sites for ecotourism and development of nature based enterprises.

ABSTRACT

We conducted an extensive avifaunal survey in the poorly known dryland hilltop forests of Kitui and Mwingi Districts to provide an inventory of the birds species. The survey covered five dryland hilltop masses namely: Mutha, Endau, Nuu, Mutito and Mumoni between October 2004 and June 2005 covering wet and dry seasons. A combination of Timed Species Counts, Mist-netting and general observations were employed to sample birds at different micro-habitat types and altitude levels. A total of 149 species within 44 families were encountered during the entire study period. A total of 363 individuals of 35 bird species were ringed through the standard mist-netting procedures. Some four Afro-Tropical and 14 Palearctic migrants were recorded. There was a total of 14 new species records for this area which included five globally threatened species, namely: African Crowned Eagle (confirmed breeding), Martial Eagle, Ayers's Hawk Eagle, Lesser Kestrel and Hinde's Babbler. Other species of conservation concern include the White Stork (*Ciconia ciconia*). These Hills are clearly important sites for raptors both Afrotropical and palaeartic migrants. These sites have high potential for bird-watching and Avi-tourism due to the high diversity and abundance of beautiful birds and sceneries. The baseline data reported here suggest that these forests are of exceptional conservation important for birds and we recommend that these sites be considered for inclusion in the Kenya's Important Bird Areas (IBA) network.

INTRODUCTION

Kenya is well endowed with various terrestrial ecosystems, which exhibit high diversity of both flora and fauna. The biodiversity in the dryland ecosystems especially that of birds is only partially known despite the growing threats of resource overexploitation owing to increasing human populations (Wass, 1995). This is exacerbated by harsh climatic conditions and changing lifestyles that disregard the traditional methods of coping with a delicate and vulnerable natural environment (Gachathi, 1996). Kenya has one of the richest avifauna in Africa (Bennun and Njoroge, 1999), harbouring over 1089 species of birds (Os-c 1996). Out of these, at least six are endemic to Kenya with small global ranges (Stattersfield *et al.*, 1998, Bennun and Njoroge 1999). Such high diversity relates to Kenya's diverse habitats including the five Endemic Bird Areas (EBAs) and six avian biomes (Stattersfield *et al.* 1998, Fishpool, 1996) which include the dry parts of Kenya Kenya is a major flyway of Palearctic migrants (Fanshawe and Bennun, 1991) where both the eastern and the western migratory pathways cross through the dry parts of the country. Around 170 of Kenya's bird species are Palearctic migrants (Os-c 1996).

Some of the interesting species-rich ecosystems are the dryland hilltops, which have been described as outliers in arid areas (IUCN, 1996). Although a number of the hilltops are protected as forest reserves, the biodiversity status is often unknown and conservation efforts are minimal, or more frequently, non-existent. These areas are known to harbour diverse and unique biodiversity owing to cooler temperatures and higher precipitation relative to the surrounding dry savannahs. Of interest are the massive hills of Kitui and Mwingi districts which emerge as 'inselbergs', from arid scrubland vegetation at 600 m plains, rising up to about 1800 m above sea level. The summits of these hills are characterized by semi-evergreen dry but sometimes mist upland forests. Currently the country has a meagre forest cover of about 1.7%, which is fast disappearing especially in the drylands exacerbated by increased exploitation of natural resources (Kenya Forest Service www.kfs.go.ke). Such hilltops not only have unique biodiversity, but also are known to have sustained human and animal life for millennia through constant supply of crucial resources as food, fodder and medicine, and spring water (Benny 2001).

The Convention on Biological Diversity mandates institutions to identify and monitor biological entities and exonerate activities likely to have adverse effects on sustainable conservation and utilization of biological resources for posterity (Glowka, *et al.*, 1994). In Africa, 1,228 Important Bird Areas (IBAs) have been identified for future conservation. There are currently 60 IBAs in Kenya covering a bewildering array of habitats (Bennun and Njoroge, 1999). These sites are selected because they hold bird species threatened with extinction, having restricted distribution, characteristic to particular biomes or are congregatory. The IBAs process sets priorities for biodiversity conservation based on existing information on bird species and their status (Collar and Stuart, 1985; ICBP, 1992; Collar *et al.*, 1994) and develops institutional capacity for biodiversity monitoring, conservation advocacy and practical actions in the country (Bennun *et al.* 2005, Bennun and Njoroge 1999). There is much information on avifauna in Kenya than most groups of organism, except large mammals which have been the traditional focus of ecological research and conservation efforts in many countries (Bennun and Njoroge, 1999). Kenya's biodiversity is under threat from an expanding human population, putting a severe pressure on the environment. Habitat loss is the primary threat to 21 out of the 23 globally threatened bird species in Kenya (Collar *et al.*, 1994).

This study aimed at inventorying avifauna, assessing current and potential threats while establishing their conservation status and sustainable utilization options in the five dryland hilltop masses, namely Mutha, Endau, Nuu, Mutito and Mumoni, in Kitui and Mwingi districts. The strong superstition and myths held by the local communities in this remote area regarding these hills has for long time enhanced their protection. The recognition of these dryland forests as IBAs will not only foster conservation action here but also promote the sites as focus for research and ecotourism. Indeed the

local peoples of this area have been marginalised in terms of participation in biodiversity conservation and development of nature based enterprises.

STUDY AREA

Kitui and Mwingi districts (figure 1) are located in the Eastern province of Kenya. They border Tana River district to the east, Taita-Taveta and Kilifi to the south, Makueni, Machakos and Embu districts to the west and Mbeere, Tharaka Nithi and Isiolo to the North. The area is located between $0^{\circ} 03'$ & $3^{\circ} 0' 0''$ South and $37^{\circ} 45'$ & $39^{\circ} 0'$ East. The districts are characterised by major plateau, referred to as Yatta, which traverse them from south to the north and are bound by Athi River on the east and Tana River on the west. This plateau is however often interrupted especially towards the eastern sides by numerous masses of hills rising from 600 m to about 1800 m a.s.l.

The climate of the two districts is arid and semi arid with characteristic erratic and unreliable rainfall. Mean annual rainfall ranges from as low as 500 mm in the lowlands to over 1050 mm in the hilltops. They experience two rain seasons, long rains between March to June and short rains between October and December. Temperature and evaporation rates are generally high with February and September being the hottest months of the year. Minimum mean annual temperatures vary between 14°C to 22°C while maximum mean annual temperatures vary between 26°C to 34°C . The vegetation is characterised by scrublands and wooded bushland (Lind & Morrison, 1974). The hilltops are characterised by upland dryforest ecosystems dominated by *Drypetes*, *Combretum*, *Vepris* and *Croton* species. Most of the hills contain perennial springs that sustain the dryland human and animal life.

This study undertook general biodiversity assessments in five hills; Mutha, Mutito, Endau, Nuu and Mumoni, which are gazetted government dryland indigenous forests with some small pockets of exotic plantations. Degradation of biodiversity in these areas has continued owing to anthropogenic effects such as illegal harvests of timber and charcoal burning, among others (GoK, 2002).

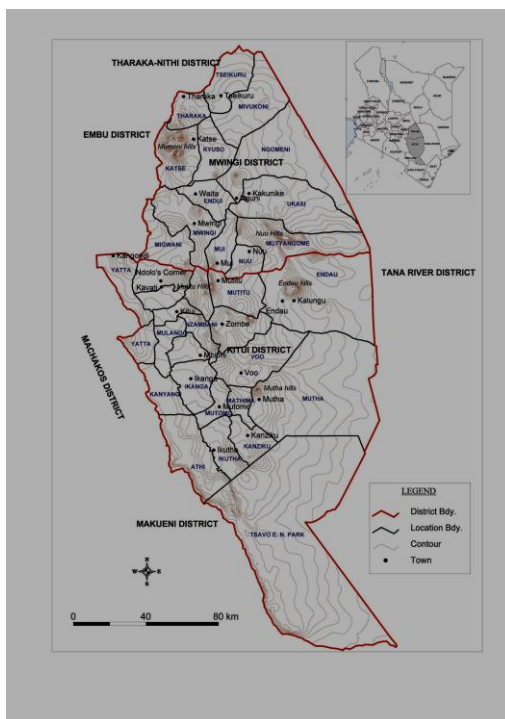


Figure 1. Map of Kitui and Mwingi districts showing major hill sites

METHODOLOGY

Various methods were employed to sample birds at different micro-habitat types and altitude levels. Data were collected in all the four compass directions around the hills and the top.

Mist-netting

Mist-nets were used to sample understorey species. Several 18m and 12m standard mist-nets (4 paneled and 3m high) were laid in the forested area along small paths and trails as far as possible to avoid habitat destruction. For each site, net lines were set in at least two altitude levels and monitored for 10 mornings and evenings, being shifted after every two days according to altitude and microhabitat types. Nets were opened at 06:00 and closed at 10:30 to be reopened again between 16:00 and 18:30 when most birds are known to be active. All birds species caught were recorded, ringed and various biometric measurements taken. Regional and country field guidebooks were used to confirm species identity (Zimmerman *et al* 1996, Stevenson & Fanshawe 2002).

Timed Species Counts (TSCs)

Times species counts were used to assess the relative abundance of bird species at one representative sites (Muumoni forest) at different altitudes and microhabitats. This entailed recording every new species seen or heard within a sampling period of 40 minutes, which was divided into four 10-minute sub-samples (Pomeroy and Tengecho 1986). For each count, species were scored according to when they were first recorded to give a 'commonness index' (4 if in the first ten minutes, 3 if in the next ten minutes and so on). During the species counts pairs of binoculars ('Swift' 10 X 50), field guides and previous experience of the birds' calls were used to aid identification. Unfamiliar calls were recorded for reference at Ornithology department library. In addition opportunistic observations made during several hiking expeditions in the hills and along side TSCs and mist-netting helped build up the species checklist.

RESULTS AND DISCUSSIONS

Species diversity

The present study is the first and most detailed assessment of the five forests of Kitui and Mwingi birds apart from the bird collection expeditions of 1890s (Ornithology collections at National Museums of Kenya). The study revealed a high diversity of unique bird species from the five sites and it provides a vital baseline for future monitoring. A total of 149 bird species within 44 families were encountered during the entire study period (Appendix 1). A total of 363 individuals of 35 bird species (Table 1) were trapped and fitted with unique metal ring-tags. Additional records were made through Timed Species Counts (TSC) along path transects (500 – 1000m long) and general observations at different altitudes. The presence of both savanna and forests bird species suggests that the forests are vital habitats for all these species and thus should be conserved to maintain the regional avian diversity including dispersal particularly for the migratory species of birds. Birds are known to be highly mobile hence these forests in some way are useful stop-over sites for birds moving between savannah and other inland mountains during different seasons. The areas surrounding these mountains are dry and often degraded by human activity thus they stand out as important refugia for birds and biodiversity. These sites are rich in rarities and new range records especially raptors which find ideal roosting, hunting and breeding grounds in high altitude undisturbed forest and rock cliffs. These hills support large number of Palaearctic migrants mainly raptors and warblers (Appendix 1).

Rarities and species of conservation concern

There were 14 records of bird species not known from this area some of which are recognised as rarities by the Bird Committee of the East African Natural History Society (Os-c 1996, Table 2) These Hills are clearly important sites for raptors, (including Afrotropical and palaeartic migrants) most of which are only suspected to occur in this ranges but had not been confirmed (Zimmerman *et al* 1996). Some of these raptors although having wide geographical distributions are scarce across their ranges. Examples of those that were observed are African Harrier Hawk, African Goshawk, Long Legged Buzzard, Little Sparrowhawk, African Goshawk and the Tawny Eagle. Some Five Globally Threatened species were also encountered including; African Crowned Eagle (Regionally Vulnerable) first confirmed breeding record in Kitui's Endau hills (also sighted in Nuu), Hinde's Babbler (Endangered and Kenyan endemic) in Muumoni, Martial Eagle in Muumoni and Mutitu, Ayres's Hawk Eagle and Lesser Kestrel both in Nuu and Muumoni – the last three are Vulnerable. Elsewhere in Kenya all these Globally Threatened species are used to qualify sites as Important Bird Areas, an approach being employed worldwide to select priority sites for biodiversity conservation (Bennun and Njoroge 1999). The confirmation of Five Globally Threatened species within these sites warrants them consideration as Important Bird Areas (IBAs) either as a block or individually.

There was a high diversity of passerine birds including migrants. One remarkable rarity was the Upcher's Warbler trapped in Nuu and Muumoni hills. In one site (Muumoni) where there was adequate data to compute species relative abundance index, Terrestrial Brownbul, Collared Sunbird, Black-backed Puffback and African Paradise Flycatcher were shown to be the commonest species while Narina Trogon and Hinde's Babbler were among the least common species (Table 3)

Table 1: List and number of bird species ringed in the five study sites

Species	NUU	MUMONI	ENDAU	MUTITO	MUTHA	Totals/species
Abyssinian White-eye	1	2	0	0	0	3
African Paradise Flycatcher	9	5	3	0	0	17
African Pygmy Kingfisher	2	21	1	0	0	24
Amethyst Sunbird	0	1	0	0	0	1
Black-backed Puffback	2	9	0	0	0	11
Black-necked Weaver	0	1	0	0	0	1
Blue-mantled Crested Flycatcher	7	12	7	7	0	33
Brown-crowned Tchagra	0	4	0	0	0	4
Collard Sunbird	1	2	1	0	0	4
Common Bulbul	1	6	0	0	0	7
Eastern Bearded Scrub Robin	0	0	2	1	0	3
Eastern Nicator	3	1	0	1	0	5

Emerald Spotted Wood Dove	1	0	1	0	0	2
Green-backed Twinspot	0	1	0	0	0	1
Grey-backed Cameroptera	7	26	4	2	1	40
Lesser Honeyguide	0	1	0	0	0	1
Narina Trogon	0	1	0	0	0	1
Northern Brownbul	1	0	1	0	0	2
Olive Sunbird	7	14	1	4	0	26
Peter's Twinspot	2	14	2	2	0	20
Red-billed Firefinch	0	0	0	1	0	1
Red cheeked Cordonbleu	2	0	0	0	0	2
Red-capped Robin Chat	5	38	5	3	2	53
Red-faced Crombec	0	1	0	0	0	1
Retz's Helmet Shrike	0	0	0	0	3	3
Rüppell's Robin Chat	0	6	0	0	0	6
Slaty-coloured Boubou	2	0	0	0	0	2
Spotted flycatcher	2	0	0	0	0	2
Sulphur-breasted Bush Shrike	0	2	0	0	0	2
Terrestrial Brownbul	7	16	5	0	14	42
Upcher's Warbler	1	0	0	0	0	1
Variable Sunbird	1	0	0	0	0	1
Yellow-bellied Greenbul	1	30	2	0	5	38
Yellow-breasted Apalis	0	2	0	0	0	2
Zanzibar Sombre Greenbul	0	1	0	0	0	1
Totals birds ringed per site	65	217	35	21	25	
Total number of birds ringed in all sites						363

Table 2: Summary of number of bird species under different categorization as they occurred in different sites.

Status	Nuu	Mumoni	Endau	Mutitu	Mutha	Totals
Palaeartic Migrants	10	8	4	1	0	14
Threatened	2	3	1	1	0	6
New range/ Rarity	2	11	3	3	3	14
Afrotropical Migrants	4	5	1	1	1	4
Forest Specialists (FF)	3	3	3	1	2	5

Forest species categories

The birds recorded in the various forests were classified into three levels of forest dependence, based on a classification done by Bennun *et al.* (1996). These are forest specialists (FF), forest generalists (F), forest visitors (f) as well as non-forest birds (s), as shown in Appendix 1. The number of FF species in a given area is an initial measure of a forest's relative conservation importance and levels of intactness. Overall, there were five FF species in the entire study area, though the surveys are still in-exhaustive. Most of the FF species occurred in Muumoni, Endau, and NuU indicating that these forests are largely undisturbed and indeed support forest dependent species in other taxa. Mutitu and Mutha hills emerged the most impoverished in terms of species richness though they were subjected to low sampling effort and have huge part covered by exotic plantations especially in Mutitu (see Table 2).

Biodiversity values

The survey revealed that game birds form an important source of protein to the local community in Kitui and Mwingi Districts. These include three Guinea fowl species that were recorded: i.e. Helmeted, Crested and Vulturine, Yellow-necked Spur fowl, Crested francolin, Sandgrouses, Quails and Bustards. There have been some small-scale pilot experiments of Guinea fowl farming in the area with promising results. The target species has been Vulturine Guinea fowls, which are the most easily habituated among the game birds in the area. If carefully conducted, this practice can be developed in to a sustainable source of protein and food security in the area as is done in Ostrich farming elsewhere.

This study was part of major biodiversity expedition by National Museums of Kenya where besides the rich diversity and abundance of birds, amazing wealth of other taxonomic groups was documented. These included

45 species of Hepertofauna, 88 species of butterflies, 19 land snails, 748 species of vascular plants, 19 small and 24 medium to large mammals. Many species in the list are new records for this area and several others are of great conservation concern.

Table 3: Results of Timed Species Counts at Muumoni forest

Species common name	Rank Index(n=18)	Encounter Probability
Terrestrial Brownbul	3.4	0.90
Collared Sunbird	3.1	0.90
Black-backed Puffback	3.1	0.90
African Paradise Flycatcher	3.0	0.83
Spot-flanked barbet	2.8	0.78
Grey-backed Camaroptera	2.7	0.72
Red-fronted Tinkerbird	2.4	0.78
Blue-mantled Crested Flycatcher	2.2	0.67
Yellow-bellied Greenbul	2.2	0.83
Common Bulbul	1.9	0.67
Slate-coloured Boubou	1.5	0.50
Chinspot Batis	1.1	0.33
Peter's Twinspot	1.0	0.33
Ruppell's Robin Chat	0.9	0.44
Red-capped Robin Chat	0.8	0.39
Tropical Boubou	0.8	0.28
Cinnamon-chested Bee Eater	0.6	0.22
Nubian Woodpecker	0.6	0.22
Forest Batis	0.6	0.17
Tawny flanked Prinia	0.6	0.22
Olive Sunbird	0.5	0.17
Red-eyed Dove	0.5	0.17
Augur Buzzard	0.4	0.17
Grey-headed Bush Shrike	0.4	0.17
Rufous Chatterer	0.4	0.11
Sulphur-breasted Bush Shrike	0.4	0.17
Black-necked Weaver	0.4	0.11
Crowned Hornbill	0.4	0.17
Twinspot Batis	0.3	0.11
Yellow-breasted Apalis	0.3	0.11
Brown-crowned Tchagra	0.2	0.11
Drongo	0.2	0.06
Eastern Nicator	0.2	0.17
Red-faced Crombec	0.2	0.06
Silvery-checked Hornbill	0.2	0.11
Abbyssinian White-eye	0.1	0.05
Emerald Spotted Wood Dove	0.1	0.11
Tambourine Dove	0.1	0.06
White-bellied Go-away-Bird	0.1	0.06
White-eye UN ID	0.1	0.06
Black-headed Oriole	0.1	0.06
Hinde's Babbler	0.1	0.06
Narina's Trogon	0.1	0.06

CONCLUSIONS AND RECOMMENDATIONS

Clearly, these isolated hilltop forests are ‘biodiversity hotspots’ which had remained unknown and have therefore not been accorded adequate protection. Since they hold such bewildering wealth of biodiversity including at least five Globally Threatened bird species we strongly recommend that these forests be recognized as Important Bird Areas or Key Biodiversity Areas. This will considerably foster their recognition and protection. These forests hold huge numbers of migratory bird species (both Palaearctic and Afro-tropical) and have been used by local herbalists to acquire important medicine for various ailments. Local communities will now have an opportunity to contribute and benefit from biodiversity conservation through nature based enterprises while they undertake biodiversity monitoring activities. They will also support conservation efforts of Kenya Forest Service through the newly adopted Participatory Forest Management (PFM) strategy.

Though these fragile forest ecosystems are under the protection of Kenya Forest Service, they are highly prone to human disturbance and loss of their unique biodiversity since the strong cultural myths protecting them are dwindling away. Though most of the sites are still intact, there is evidence of destruction in some forests by the local people who acquire some the forests products mainly firewood, construction poles and medicine.

With the growing recognition and viability of involving local community in conservation of natural resources existing on their neighbourhood, we recommend initiation of community conservation programs in this area in order to aid in instituting sustainable conservation practices for these forests. These forests are an important water sources for the local community as well as a source for non-commercial products such as medicinal plants, honey and pasture (with extreme examples of wild cows in Muumoni hills). Although there are some initiatives in the area on sustainable use of certain resources such as Bee Keeping and Silk worm rearing (ICIPE 2006), they are still at a small scale. Recognising these forests as priority sites for biodiversity conservation, will provide a justification for fund raising to support more community based initiatives that address poverty alleviation and livelihoods using the rich biodiversity. Results of Game Bird farming pilot experiments especially in Mutha area had some promising results. Vulturine Guineafolws, which are best candidates, are abundant in the lower altitude settlement areas neighbouring the Kitui South Game Reserve. If carefully conducted, game bird farming can be developed in to a sustainable source of protein and food security in the area. These hills have a great potential for ecotourism given their accessibility, spectacular sceneries, rich biodiversity and excellent hiking grounds.

This project helped raise awareness as well as building local capacity for appreciation of biodiversity conservation by involving the local community members as field assistants and through opportunistic interactions with local administration, CBOs and other projects in the area. It is noteworthy that, the strong traditional myths and cultural believes that have prohibited local communities form destroying these forests have played a key role in enhancing bird and biodiversity conservation in the forests and continued availability of water resources.

This survey was however only a rapid baseline assessment and more intensive research with more time is required in order to expand this checklist and establish boundaries for this potential IBA. Community conservation groups need to be established in this area to further create conservation awareness and initialize a monitoring scheme.

REFERENCES

- Bennun, L. A. and Njoroge, P. 1999. Important Bird Areas of Kenya. East Africa Natural History Society.
- Bennun, L. Dranzoa, C. & Pomeroy, D. 1996. The forest birds of Kenya and Uganda. *Journal of East African Natural History*. 85: 23-48.
- Bennun, L., Matiku, P., Mulwa, R., Mwangi, S. and Buckley, P. (2005) Monitoring Important Bird Areas in Africa: towards a sustainable and scaleable system. *Biodiversity and Conservation* 14(11): 2575–2590.
- Benny B. 2001. Taita Hills Biodiversity Project Report. National Museums of Kenya, Nairobi.
- Collar, N. J, Crosby, M.J. and Stattersfield, A.J. (1994). *Birds to Watch 2. The World List of Threatened Species*,
Birdlife International, Cambridge.
- Collar, N. J. and Stuart, S. N. (1985). *Threatened Birds of Africa and Related Islands: The ICPB/IUCN Red Data Book*, ICPB/IUCN Cambridge,
- Fanshawe, J.F. and Bennun, L.A. (1991). Bird conservation in Kenya: creating a national strategy. *Bird conserve. Internl.* 1: 293-315.
- Fishpool, L. (1996). *IBA in Africa. IBA criteria, categories and thresholds*. Birdlife International, Cambridge.
- Gachathi, F.N.M (1996). Conservation priorities in the arid and semi-arid lands: the case of the hilltop forests in Kenya. The Biodiversity of African Plants, Proceedings XIVth AETFAT Congress, Wageningen, The Netherlands. Pp 313-316.
- Glowka, L., F. Burhenne-Guilmin, & H. Ssyngé (1994). A guide to the Convention on Biological Diversity. IUCN-the World Conservation Union, Gland, Switzerland and Cambridge, UK.
- Government of the Republic of Kenya (GoK), (2002). Ministry of Finance and Planning, Kitui district development plan 2002-2008. Government Printer, Nairobi.
- ICIPE (International Center for Insect Physiology & Ecology) 2006. (Eds. Mulwa R. and Machekele J.) Developing Incentives for Community Participation in Forest Conservation through the use of Commercial Insects in Kenya. Baseline Socio-economic Survey for Mumoni, Imba and Nuu Forests in Mwingi District, Nairobi.
- Ornithological Sub-Committee (Os-c) (1996). *Check-List of the Birds of Kenya*, East African Natural History Society, Nairobi.
- Pomeroy D. and Tengecho B. 1986. Studies of Birds in a Semi-Arid Area of Kenya. III-The Use of 'Timed Species-Count's for Studying Regional Avifaunas. *Journal of Tropical Ecology*, Vol. 2, No. 3. pp. 231-247.
- IUCN, (1996). Forest cover and forest reserves in Kenya: Policy and practice. IUCN Eastern Africa Regional Office. Pp 23
- Lind, E.W. & Morrison, M.E.S. 1974. East African Vegetation. Longman, London.
- Stattersfield, A. J., Crossby, M. J., Long, A. J. and Wege, D. C. 1998. Endemic Birds of the world: Priorities for bird conservation. Cambridge, UK: BirdLife International, BirdLife Conservation Series 7.
- Stevenson T. & Fanshawe J. (2002) Field Guide to the Birds of East Africa – *Kenya, Tanzania, Uganda, Rwanda and Burundi*. Christopher Helm London
- Zimmerman, D. A., Turner, D. A. & Pearson D. J. 1996. Birds of Kenya and Northern Tanzania. Russel Friedman 740.
- Wass, P. (Ed.) (1995). Kenya's Indigenous Forests: Status, Management and Conservation. IUCN, Gland, Switzerland and Cambridge, UK.

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Appendix 1: Taxonomic checklist of bird species recorded in the five Hills of Kitui and Mwingi in October 2004.

Family	Species	scientific name	Status	Nu	Mm	En	Mt	Ma	Sites
Scopidae	Hamerkop	<i>Scopus umbreta</i>	s	X	X	X			3
Ciconiidae	White Stork**	<i>Ciconia ciconia</i>	PM	X		X			2
Therskiornithinidae	Hadada Ibis	<i>Bostrychia hagedash</i>	s	X	X				2
Accipitridae	African Crowned Eagle**	<i>Stephanoaetus coronatus</i>	FF, RT, Br	X		X			1
	African Harrier Hawk	<i>Polyboroides typus</i>	f	X	X	X	X	X	5
	African Hawk Eagle	<i>Hieraaetus spilogaster</i>	f	X					1
	Augur Buzzard	<i>Buteo augur</i>	s, Nr	X	X	X		X	4
	Ayres's Hawk Eagle	<i>Hieraaetus ayresii</i>	Vu	X	X				2
	Booted Eagle	<i>Hieraaetus pennatus</i>	R, PM	X	X				2
	Brown Snake eagle	<i>Circaetus cinereus</i>	s, Nr	X	X	X	X	X	5
	Great Sparrowhawk	<i>Accipiter melanoleucus</i>	F, Nr			X			1
	Martial Eagle**	<i>Polemaetus bellicosus</i>	s, Vu		X		X		2
	Little Sparrowhawk	<i>Accipiter minullus</i>	f, Nr, R		X				1
	Long-legged Buzzard**	<i>Buteo rufinus</i>	PM, V, Nr				X		1
	Steppe Eagle	<i>Aquila nipalensis</i>	PM		X				1
	Tawny Eagle	<i>Aquila rapax</i>	s	X		X			2
	African Goshawk	<i>Accipiter tachiro</i>	F	X		X			2
	Gabar Goshawk*	<i>Micronisus gabar</i>		X					1
	Verreaux's Eagle	<i>Aquila verreauxii</i>	S		X			X	2
Wahlberg's Eagle	<i>Aquila wahlbergi</i>	AM		X				1	
Southern Banded Snake Eagle**	<i>Circaetus fasciolatus</i>	NT, Nr, R		X				1	
Falconidae	Lesser Kestrel	<i>Falco naumanni</i>	PM, Vu	X	X				2
Phasianidae	Crested Francolin	<i>Francolinus sephaena</i>	s					X	1
Numididae	Crested Guineafowl	<i>Guttera pucherani</i>	F	X	X	X	X	X	5
	Helmeted Guineafowl	<i>Numida meleagris</i>	s					X	1
	Vulturine Guineafowl	<i>Acryllium vulturinum</i>	s					X	1
	Yellow-necked Spurfowl	<i>Francolinus leucoscepus</i>	s		X			X	2
Pteroclididae	Black-faced Sandgrouses	<i>Pterocles decoratus</i>	s					X	1
Columbidae	Emerald-spotted Wood Dove	<i>Turtur chalcospilos</i>	f	X	X	X	X	X	5
	Laughing Dove	<i>Streptopelia senegalensis</i>	f	X	X	X	X	X	5
	Red-eyed Dove	<i>Streptopelia semitorquata</i>	f	X	X	X	X	X	5
	Tambourine Dove	<i>Turtur tympanistris</i>	F, Nr		X				1
	Feral Pigeon	<i>Columba livia</i>		X					1
	Speckled Pigeon	<i>Columba guinea</i>		X					1
Psittacidae	African Orange-bellied Parrot	<i>Poicephalus rufiventris</i>	s	X	X				2
Musophagidae	White-bellied Go-away-Bird	<i>Corythaixoides leucogaster</i>	s		X				1
Cuculidae	Klaas's Cuckoo	<i>Chrysococcyx klaas</i>	f		X				1

	African Emerald Cuckoo	<i>Chrysococcyx cupreus</i>		X	X					2
	Diederik Cuckoo	<i>Chrysococcyx caprius</i>			X					1
	Red-chested Cuckoo	<i>Cuculus solitarius</i>			X					1
	Black Cuckoo	<i>Cuculus clamosus</i>	R, AM	X	X					2
	White-browed Coucal	<i>Centropus superciliosus</i>	s	X	X		X			3
	Yellowbill	<i>Ceuthmochares aereus</i>	F	X			X			2
Strigidae	African Wood Owl	<i>Ciccaba woodfordii</i>	F		X		X			2
	Owl spp (Small Owl)	<i>Un identified sp.</i>		X						1
Apodidae	Little Swift	<i>Apus affinis</i>		X	X					2
	African Palm Swift	<i>Cypsiurus parvus</i>		X						1
Coliidae	Blue-naped Mousebird	<i>Urocolius macrourus</i>				X				1
	Speckled Mousebird	<i>Colius striatus</i>	f		X					1
Trogonidae	Narina Trogon	<i>Apaloderma narina</i>	F	X	X	X	X			4
Alcedinidae	African Pygmy Kingfisher	<i>Ispidina picta</i>	f	X	X					2
	Grey-headed Kingfisher	<i>Halcyon leucocephala</i>	AM	X	X					2
Meropidae	Cinnamon-chested Bee Eater	<i>Merops oreobates</i>	f, Nr		X					1
	Eurasian Bee-eater	<i>Merops apiaster</i>	f, PM	X		X				2
Coraciidae	Eurasian Roller	<i>Coracias garrulus</i>	PM	X	X					2
Phoeniculidae	Green Wood-hoopoe	<i>Phoeniculus purpureus</i>		X						1
	Common Scimitarbill	<i>Rhinopomastus cyanomelas</i>			X					1
Bucerotidae	Crowned Hornbill	<i>Tockus alboterminatus</i>	f	X	X	X	X	X		5
	African Grey Hornbill	<i>Tockus nasutus</i>	s		X					1
	Silvery-cheeked Hornbill	<i>Bucorvus brevis</i>	F, Nr		X					1
Capitonidae	White-headed Barbet	<i>Lybius leucocephalus</i>	s	X	X	X				3
	D'Arnaud's Barbet	<i>Trachylaemus darnaudii</i>			X					1
	Red-and-yellow Barbet	<i>trachylaemus erythrocephalus</i>		X	X					2
	Spot-flanked Barbet	<i>Tricholaema lacrymosus</i>	s	X	X	X	X	X		5
	Red-fronted Tinkerbird	<i>Pogoniulus pusillus</i>	s	X	X	X		X		4
	Yellow-rumped Tinkerbird	<i>Pogoniulus bilineatus</i>			X					1
Indicatoridae	Lesser Honeyguide	<i>Indicator minor</i>	f	X	X					2
Picidae	Cardinal Woodpecker	<i>Dendropicos fuscescens</i>		X						1
	Nubian Woodpecker	<i>Campethera nubica</i>	s		X					1
Hirundinidae	Barn Swallow	<i>Hirundo rustica</i>	PM		X					1
	Lesser Striped Swallow	<i>Hirundo abyssinica</i>		X						1
	Plain Martin	<i>Riparia paludicola</i>	S		X	X				2
Pycnonotidae	Common Bulbul	<i>Pycnonotus barbatus</i>	f	X	X	X	X	X		5
	Cabanis's Greenbul	<i>Phyllastrephus cabanisi</i>	FF					X		1
	Yellow-bellied Greenbul	<i>Chlorocichla flaviventris</i>	F	X	X		X	X		4
	Zanzibar Sombre Greenbul	<i>Andropadus importunus</i>	s	X	X	X				3

	Eastern Nicator	<i>Nicator chloris</i>	F	X	X	X	X		4
	Northern Brownbul	<i>Phyllastrephus strepitans</i>	f	X		X			2
	Terrestrial Brownbul	<i>Phyllastrephus terrestris</i>	F	X	X		X	X	4
Timaliidae	Hinde's babbler **	<i>Turdoides hindei</i>	En, Nr		X				1
	Rufous Chatterer	<i>Turdoides rubiginosus</i>	s		X				1
Turdidae	Red-capped robin chat	<i>Cossypha natalensis</i>	F	X	X	X	X	X	5
	Spotted Morning Thrush	<i>Cichladusa guttata</i>			X				1
	Eastern Bearded Scrub Robin	<i>Cercotrichas quadrivirgata</i>	F	X		X	X		3
	Rüppell's Robin-Chat	<i>Cossypha semirufa</i>	f, Nr		X				1
	Bare-eyed Thrush,	<i>Turdus tephronotus</i>	s	X	X	X			3
Muscicapidae	African Dusky Flycatcher	<i>Muscicapa adusta</i>	F					X	1
	African Grey Flycatcher	<i>Bradornis microrhynchus</i>	s	X			X		2
	Southern Black Flycatcher	<i>Melaenornis pammelaina</i>			X				1
	Pale Flycatcher	<i>Bradornis pallidus</i>	s	X					1
	Ashy Flycatcher	<i>Muscicapa caerulescens</i>	F				X		1
	Spotted Flycatcher	<i>Muscicapa striata</i>	s, PM	X	X	X			3
Sylviidae	Grey-backed Camaroptera	<i>Camaroptera brachyura</i>	f	X	X	X	X	X	5
	Upcher's Warbler	<i>Hippolais languida</i>	R, PM	X	X				2
	Rattling Cisticola	<i>Cisticola chiniana</i>	s		X				1
	Chiffchaff	<i>Phylloscopus collybita</i>	F, R, PM	X					1
	Red-faced Crombec	<i>Sylvietta whytii</i>	s		X				1
	Tawny-flanked Prinia	<i>Prinia subflava</i>	f	X	X		X		3
	Singing Cisticola	<i>Cisticola cantans</i>			X				1
	Yellow-breasted Apalis	<i>Apalis flavida</i>	f		X			X	2
Zosteropidae	Abbyssinian White-eye	<i>Zosterops abyssinicus</i>	f	X	X				2
	Yellow White-eye	<i>Zosterops senegalensis</i>	f		X				1
Monarchidae	Blue-mantled Crested Flycatcher	<i>Trochocercus cyanomelas</i>	FF	X	X	X	X		4
	African Paradise Flycatcher	<i>Terpsiphone viridis</i>	f, AM	X	X	X	X	X	5
	White-tailed Crested Flycatcher*	<i>Trochocercus albonotatus</i>	FF, R, Nr					X	1
Platysteiridae	Black-headed Batis	<i>Batis minor</i>	s			X	X	X	3
	Chin-spot Batis	<i>Batis molitor</i>	s		X		X	X	3
	Forest Batis	<i>Batis mixta</i>	s, Nr		X				1
Prionopidae	Retz's Helmet-shrike	<i>Prionops retzii</i>	f	X	X	X	X	X	5
	Northern White-crowned Shrike	<i>Eurocephalus rueppelli</i>		X					1
Laniidae	Red-tailed Shrike	<i>Lanius isabellinus</i>	PM	X	X				2
Malaconotidae	Black-backed Puffback	<i>Dryoscopus cubla</i>	F	X	X	X	X	X	5
	Brown-crowned tchagra	<i>Tchagra australis</i>	s		X				1
	Tropical Boubou	<i>Laniarius aethiopicus</i>	f		X				1
	Grey-headed Bush-Shrike	<i>Malaconatus blanchoti</i>	s	X	X		X		3

	Sulphur -breasted bushrike	<i>Malaconatus sulfereopectus</i>	f		X					1
	Slate-coloured Boubou	<i>Laniarius funebris</i>	s	X	X		X			3
Dicruridae	Common Drongo	<i>Dicrurus adsimilis</i>		X	X					2
Oriolidae	Black-headed Oriole	<i>Oriolus larvatus</i>	f	X	X	X			X	4
	Eurasian Golden Oriole,	<i>Oriolus oriolus</i> ,	PM	X		X				2
Corvidae	Fan-tailed Raven	<i>Corvus rhipidurus</i>	s					X		1
Sturnidae	Red-billed Oxpecker	<i>Buphagus erythrorhynchus</i>	s			X				1
	Greater Blue-eared Starling	<i>Lamprotornis chalybaeus</i>	f			X				1
	Red-winged Starling	<i>Onychognathus morio</i>	f				X			1
	Rüppell's Long Tailed Starling	<i>Lamprotornis purpuropterus</i>	s			X				1
	Superb Starling	<i>Lamprotornis superbus</i>	s			X				1
Nectariniidae	Amethyst Sunbird	<i>Nectarina amethystina</i>	f			X	X			2
	Black-bellied sunbird	<i>Nectarinia nectarinioides</i>	s						X	1
	Collard Sunbird	<i>Anthreptes collaris</i>	F	X	X	X	X			4
	Olive Sunbird*	<i>Nectarina olivacea</i>	FF	X	X	X	X			4
	Scarlet-chested Sunbird	<i>Nectarinia senegalensis</i>	s			X				1
	Variable Sunbird	<i>Nectarina venusta</i>	f	X		X	X	X	X	4
Passeridae	House Sparrow	<i>Passer domesticus</i>	s			X				1
Ploceidae	Black-headed Weaver	<i>Ploceus cucullatus</i>	f			X				1
	Black-necked Weaver	<i>Ploceus nigricollis</i>	f			X				1
	Chestnut Weaver	<i>Ploceus rubiginosus</i>	AM	X	X					2
	African Golden Weaver	<i>Ploceus subaureus</i>	s	X	X					2
	Golden Palm Weaver	<i>Ploceus bojeri</i>	s			X				1
	Lesser Masked Weaver	<i>Ploceus intermedius</i>	s			X				1
	Vitelline Masked Weaver	<i>Ploceus velatus</i>	s	X						1
	White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>	s			X				1
	White-winged Widowbird	<i>Euplectes albonotatus</i>	s			X				1
	Yellow Bishop	<i>Euplectes capensis</i>	s			X				1
Estrildidae	Bronze Mannikin	<i>Lonchura cucullata</i>	F			X				1
	Black-and-white Mannikin	<i>Lonchura bicolor</i>	F			X				1
	Green-backed Twinspot*	<i>Mandingoa nitidula</i>	FF			X				1
	Peter's Twinspot	<i>Hypargosniveoguttatus</i>	F, Nr			X		X		2
	Red-billed Firefinch	<i>Lagonostica rufopicta</i>	s	X				X		2
	Red-cheeked Cordon-bleu	<i>Uraeginthus bengalus</i>	s	X	X					2
Number of species per site				78	110	41	39	32		
Total Number of Species										149

Key: FF – Forest specialist, F – forest generalist, f – forest visitor, s – non-forest species, PM – Palaearctic

AM - Afrotropical Migrants, R - Rarity, V – Vagrant species, RT- Regionally Threatened, Br – Rare Breeding record,

NT - Near Threatened, Vu - Vulnerable, Nr – New range, ** - highlights species of particular interest, * - unconfirmed record

Hills - Nu = Nuu, Mm =Mumoni, En = Endau, Mt = Mutito, Ma = Muthaa