

**ASSESSMENT OF THE EFFECTS OF LAND COVER CHANGE, LOCAL
PERCEPTION AND GOVERNANCE ON THREATENED GRASSLAND BIRDS: A
CASE OF MAU NAROK- MOLO GRASSLANDS, KENYA**

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Summary

Field work started in the month of April to early July 2015 which involved pre visits, administering of questionnaires to find out the socio- economic activities, local perception and governance in the area and later birds surveys were conducted. The results showed that between 1984 and 2000, forest and grassland decreased by 42% and 6% respectively while farmlands and water bodies increased by 38% and 483%. Between 2000 and 2014, there was a decrease in grassland and water bodies by 13% and 65% respectively while forest and farmland increased by 57% and 0.97% respectively. Jackson's widowbird recorded the highest number of individuals, total of 341 while Sharpe's Longclaw was the third most sighted species with a total of 58 individual. Only 13 individuals of Aberdare Cisticola were recorded. Majority of the respondents were farmers, 74.4% in Molo and 57.6% in Mau-Narok, followed by business (29.14%) in Molo and Pastoralism (25.8%) in Mau Narok. This means that majority of the respondents depend on crop and livestock products as the main source of income. Fire (17.8%), crop farming (80%) which is as a result of increased population and grazing (21.1%) remain to be the major threats in the IBA. There is no any governance or institution dealing with conservation of this important habitat and the threatened birds that depend on it for survival.

Study area

The study was conducted in the Mau Narok-Molo grassland which is an Important Bird Area. The IBA is located in Nakuru County and a small part falls in Narok County. This IBA is located between longitude 35° 55'.38" East and latitude 0° 36'.7" South along the crest of the Mau Escarpment, which forms the western wall of the central Rift Valley. It covers approximately 80 km South-East to North-West, and is bounded on each side with partial interruption by the Mau forest complex. The altitude ranges from 2,700 – 3,100 m (BirdLife International, 2014).

The area receives an average rainfall of 1,000 mm per year with an average temperature of 12.9°C. The topography is predominantly rolling land with slopes ranging from 2% in the plains. Soils are of clay loam to loam in texture, with friable consistence and weak to moderate sub-angular blocky structure with pH values ranging from 5.6 to 6.4 (Sombroek *et al.*, 1980). The original vegetation is short grassland, with some heather and scrub on the ridges where the soil is deeper. Some part of Mau forest is found in between the grassland (BirdLife International, 2014).

The population of Nakuru County is 1,603,325 while that of Narok County is 850,920. Molo has a population of 107,806 and 43,089 in Mau Narok (GoK, 2009). The main communities found in the study are the Kalenjins and Kikuyu who have settled in Molo and northern Mau Narok whereas the Maasai community occupies the southern part of Mau Narok. Majority of Kikuyus and Kalenjins practice small scale crop farming and a few practice large scale farming, which is the main economic activity while Maasai carry out livestock farming. Cereals (maize, barley and wheat) are the major crops, and much grassland has been converted by ploughing and re-seeding with exotic species to provide better grazing for livestock (BirdLife International, 2014).

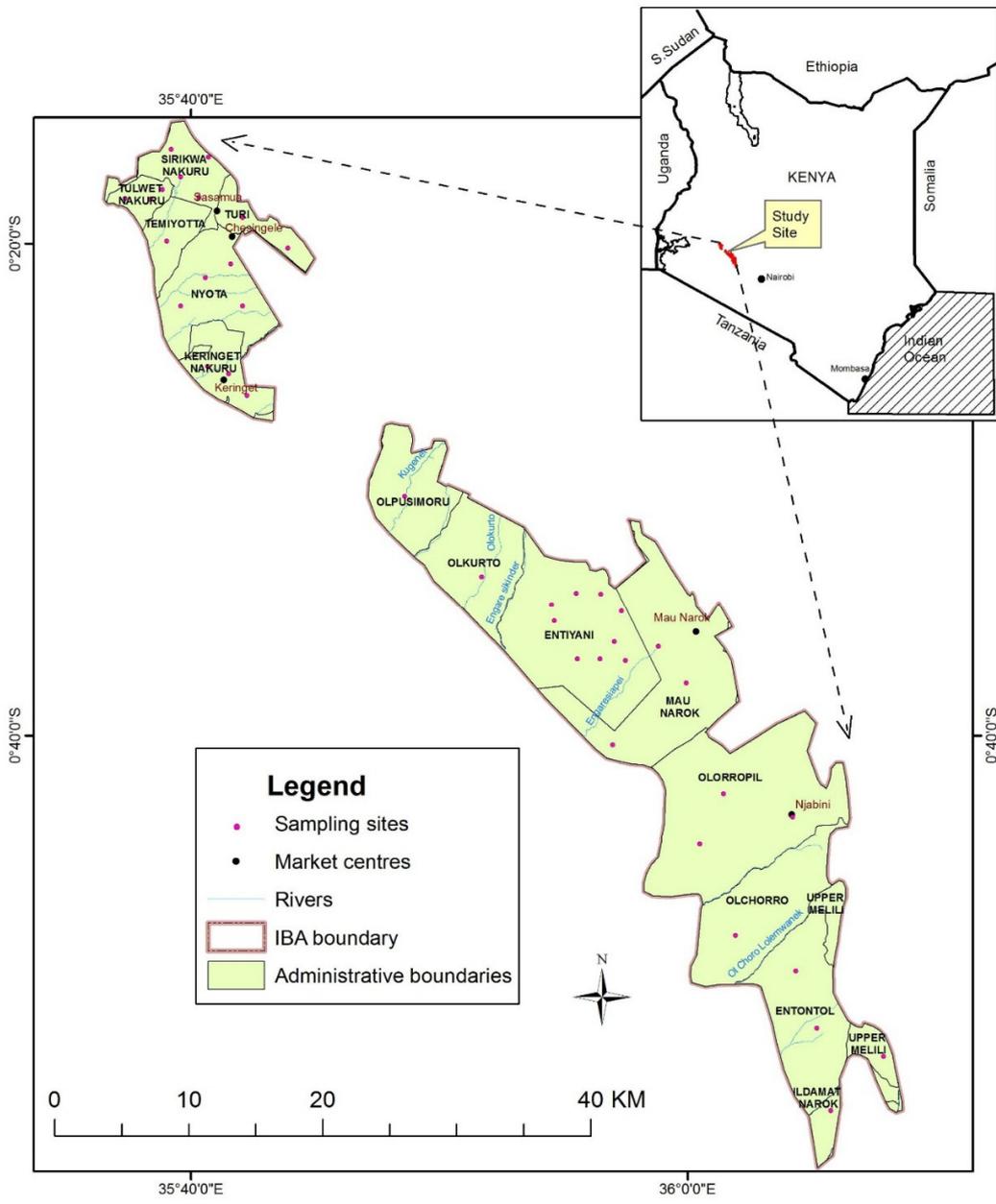


Figure 1: Map of Mau Narok-Molo Grassland IBA

Land use land cover change

The area of study was defined based on the BirdLife International Important Bird Area boundary. Satellite images were acquired from Regional Centre for mapping of Resource for Development (RCMRD). Landsat imageries as from 1984 to 2014 with an interval of 15 years (i.e. 1984, 1999, and 2014) were analyzed to show the extent of grass cover change over a period of thirty years. Early 1980s is when the area underwent a substantial land cover change due to population increase (Baldyga *et al.*, 2008). During acquisition, images were selected based on availability (common season) and clarity (percentage of the cloud cover) in terms of systematic swath coverage.

The study area falls under two Landsat images scene P169R60 and P169R61. Images for the following years were acquired: Feb. 2014 (Landsat 8), Feb. 2000 (Landsat ETM) and Jul. 1984 (Landsat TM) having considered cloud cover and common period. Image processing software IDRISI, was used to select vegetation mapping bands i.e. 2, 3 and 4 and then clipped based on area of the study and composite that is recommended for vegetation mapping. Using ArcGIS software, the three images were overlaid or super imposed to check on their uniformity in terms of geo-referencing and co-registration. Image enhancement was carried out on the three images to improve color contrast.

The land cover types for Mau Narok - Molo IBA were clustered and grouped into four predominant groups: Forest, Grassland, Farmland and Water body. The results are illustrated diagrammatically as shown in Fig. (1, 2, 3) and Tables 1 below.

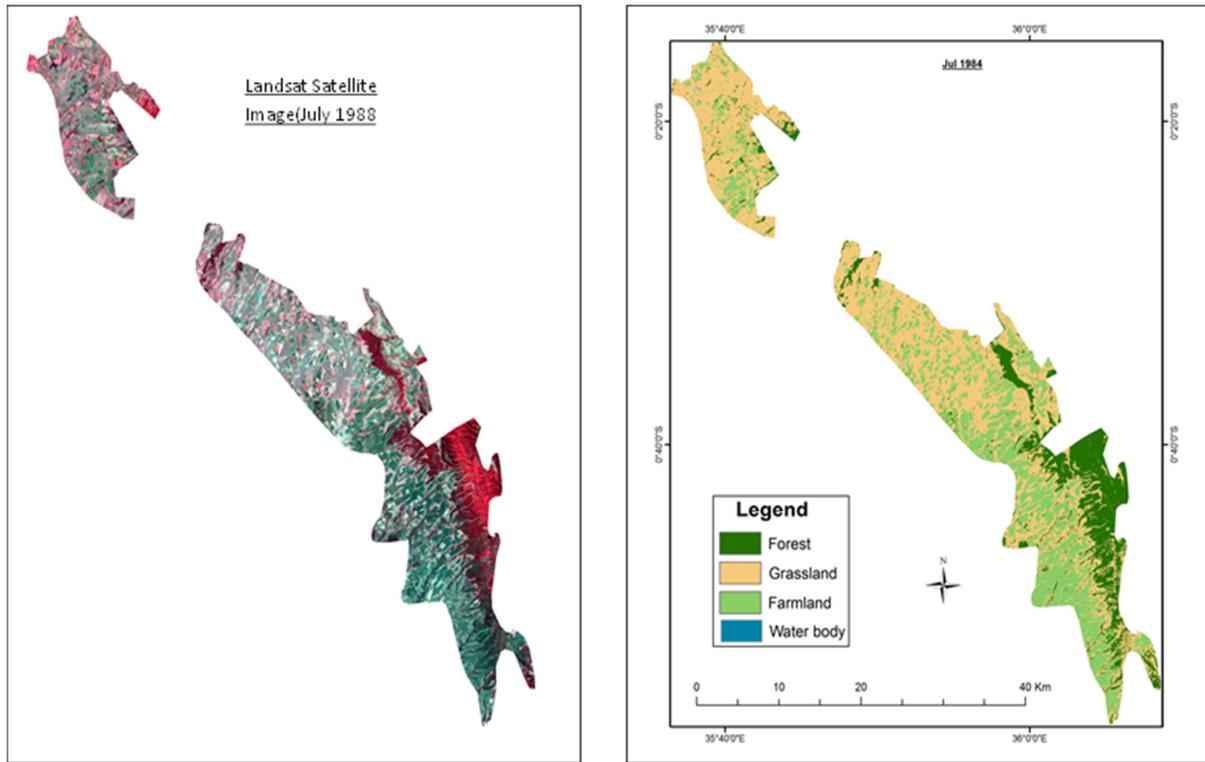


Figure 2: Land use land cover status of Mau Narok- Molo IBA, 1984

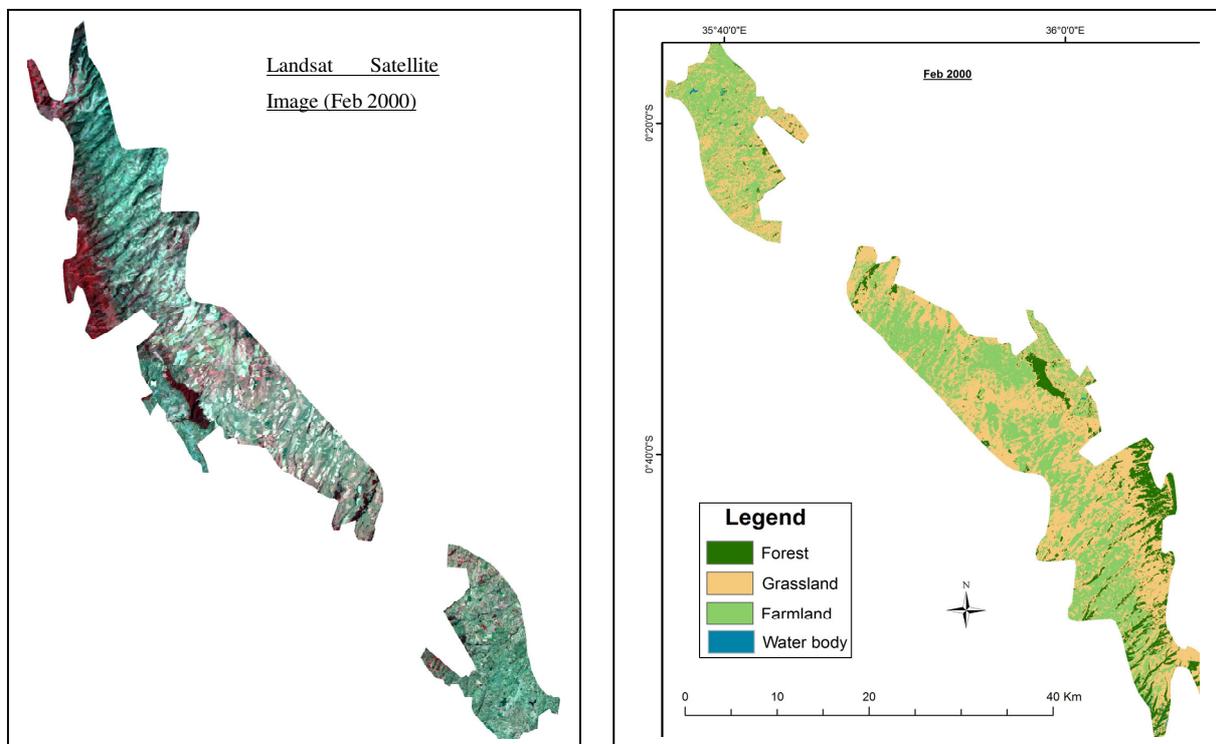


Figure 3: Land use land cover status of Mau Narok- Molo IBA, 2000

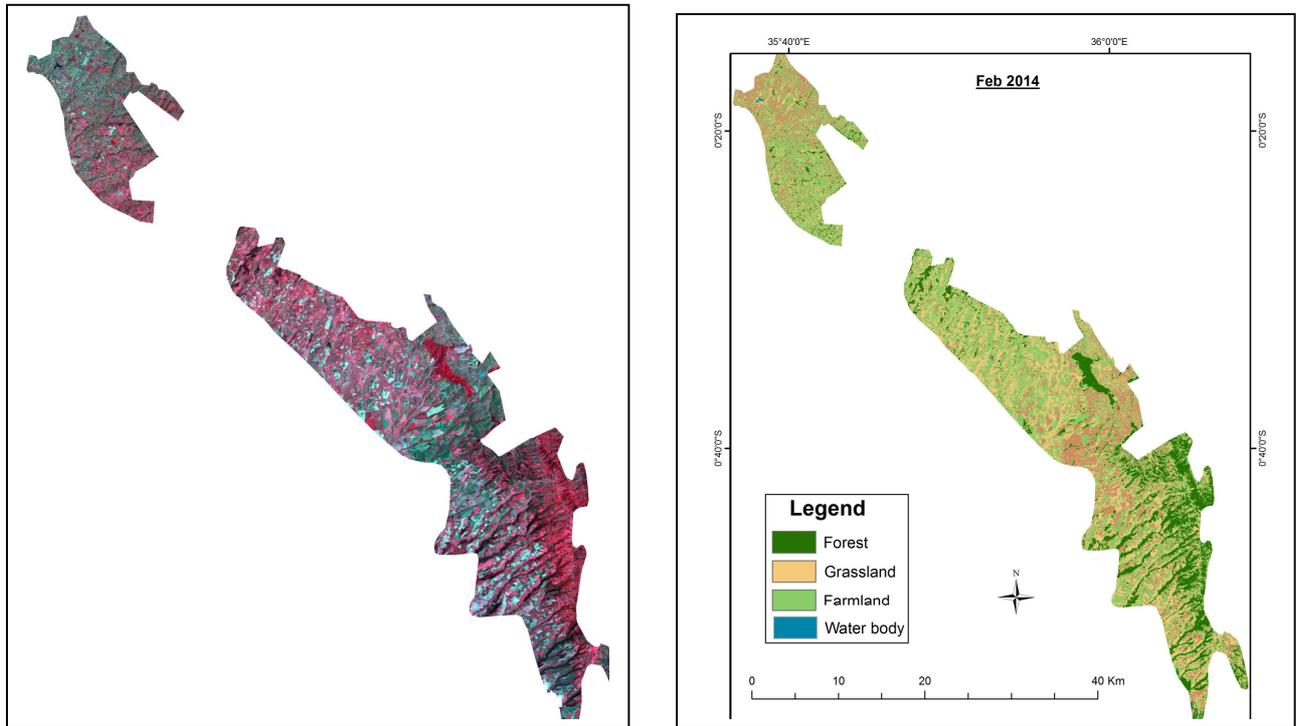


Figure 1: Land use land cover status of Mau Narok- Molo IBA, 2014

Landsat images of land use and land cover changes in Mau Narok- Molo IBA highlighted significant changes in land use and land cover over the period 1984 to 2014. The period between 1984 and 2000 indicated a lot of anthropogenic activities that resulted in reduction of grasslands and forest. Grassland is the dominant land cover in the study area; it showed a reduction of 6% (24.65Km²) between the years of 1984 and 2000. There was also a significant decline in forest cover, 42% (55.42km²), this concurs with previous findings that there was the worst degradation of forest and other vegetation between 1986-2000 (Ayuyo and Sweta, 2014).

Table 1. Land cover and change in 1984, 2000 and 2014 in Km²

Classes	Years of Acquisition				
	1984	2000	2014	1984-2000 % Δ	2000-2014 % Δ
Forest	132.08	76.66	120.60	-42	+57
Grassland	383.32	358.67	313.29	-6	-13
Farmlands	209.30	288.15	290.95	+38	+0.97
Water body	0.36	2.10	0.73	+483	-65

Overall, forest cover had the highest percentage decline with farmland having the highest increase of 38% (78.85km²) at the expense of grassland and forest cover loss in the same period. Were *et al.*, (2013) recorded an overall reduction in forest-shrub lands and grassland and an increase in croplands and built-up lands between 1973 and 2011 in the eastern part of Mau. The deterioration of the two covers was probably due to increased population and expansion of agriculture in the area as a result of illegal allocation and land grabbing that took place between 1984 and 2000.

Fortunately, the general outcry from various stakeholders, national and international institutions for conservation of the Mau complex and the ultimate involvement of the Mau rehabilitation, the Kenya government took a step in addressing the threat of rapid degradation of its Mau forest resources in 2005. Since then the conservation work seemed to have borne fruit since there was 43.94% (43.94km²) increment in forest cover between the periods 2000-2014. This findings were similar to previous studies (Ayuyo and Sweta, 2014; Olang and Kundu, 2011). Grassland cover continued to show a reduction of 13% (45.38Km²) in the same period. This could be as a result of people extending their agricultural activities to grasslands because of conservation work taking place in the area to protect the forest cover and not grasslands.

Satellite captures all type of grass include those that are found even along the road side and fragmented grasslands. The actual size of grassland remaining that are suitable for Sharpe's Longclaw, Aberdare Cisticola and Near-Threatened Jackson's Widow Bird may be further much reduced.

Bird survey

The populations of three threatened grassland birds were estimated through line transect count randomized across the study site which was established by walking along the transects measuring 0.5km for small patch (<5ha), 1km for medium sized patch (5 to 20ha) and 1.5 km for large grassland patch (>20ha) were surveyed two times each after a period of two weeks. A total of 36 patches were surveyed, 12 in Molo and 24 in Mau-Narok. Sharpe's longclaw, *Macronyx sharpie* (Endangered) Aberdare cisticola, *Cisticola aberdare* (Endangered) and Jackson's widowbird *Euplectes jacksoni* (Near-threatened) encountered including other bird species, were recorded together with the perpendicular distances to the transect. Population estimates from the two surveys were averaged to obtain one figure for each species.

A total of 62 species of birds were recorded in the study area. Jackson's Widowbird recorded the highest number of individuals, a total of 341 (Molo-7 and Mau-Narok-268) in 11 plots, 58 individuals of Sharpe's Longclaw (Molo-17 and Mau-Narok-41) in 16 plots while for Aberdare Cisticola, a total of 13 individuals (Molo-5 and Mau-Narok-8) were recorded in 11 plots.

Jackson's Widowbird was mostly found displaying in the remaining grassland and sometimes in wheat and barley farms feeding. Sharpe's Longclaw was only found in grasslands, meaning they depend entirely on grassland for feeding and breeding unlike Jackson's Widowbird. The ongoing cultivation and grazing is putting Sharpe's Longclaw at a higher risk of extinction.

Socio-economic activities factors influencing the current grassland in Mau Narok-Molo

Stratified sampling was used to obtain the number of households per location where the sample unit in each location was proportionate to the total number of households. Random sampling was used to get the household that will be interviewed. Questionnaires were administered to 150 locals in the following areas Kerringet, Turi, Nyota, Sirikwa Tulwet, Olposmoru, Olkurto, Entiani, Olchoro and Entontol.

The main communities found in the study are the Kalenjins and Kikuyu who have settled in Molo and northern Mau Narok whereas the Maasai community occupies the southern part of Mau Narok. Majority of Kikuyus and Kalenjins practice small scale crop farming and a few practice large scale farming, which is the main economic activity while Maasai practice livestock farming (BirdLife International, 2014).

Demographic characteristics of the respondents

Household headship was male dominated in both Molo and Mau-Narok, 76.7 % and 75.8% while 23.3% and 24.2% of the respondents were the head of households respectively. Results indicate that the majority of the respondents were between the ages of 31-40 years. Most of the respondents are therefore within the active working age category. Majority of the respondents in Molo (51.2 %) had attained eight years of education and below, 29.1 % had on the other hand attained twelve years of education and below, while 10.5% had acquired some professional skills from either tertiary colleges or universities. A substantial percentage, 9.3 % had no formal education. In Mau-Narok, majority of the respondents (43.9%) had no formal education, 27.3% had attained eight years of education and below, 22.7% had attained twelve years of education

and below while 6.1% had post-secondary education. Looking at the four-category occupational classification, majority of the respondents were farmers, 74.4% in Molo and 57.6% in Mau-Narok. The second major occupational category is business (29.14%) in Molo and Pastoralism (25.8%) in Mau Narok. 10.5% of the respondents in Molo and 12.1% in Mau-Narok are formally employed while 29.14% (Molo), and 13.6% (Mau-Narok) are working as casuals.

Table 2: Demographic Characteristics

Variable		Molo		Mau-Narok	
		Frequency	Percent	Frequency	Percent
Gender	Male	66	76.7	50	75.8
	Female	20	23.3	16	24.2
Age	20-30	12	14.0	11	16.7
	31-40	27	31.4	21	31.8
	41-50	27	31.4	15	22.7
	51-60	12	14.0	7	10.6
	Above 61	8	9	12	18.2
Educational Level	None	8	9.3	29	43.9
	Primary	44	51.2	18	27.3
	Secondary	25	29.1	15	22.7
	Tertiary	9	10.5	4	6.1
Occupation	Farming	64	74.4	38	57.6
	Business	25	29.1	9	13.6
	Formal employment	9	10.5	8	12.1
	Pastoralism	5	5.8	17	25.8
	Casual labour	7	8.1	9	13.6

Sources of income

Respondents' income in the IBA is mainly drawn from eight sources namely: sale of agricultural products (from crops), employment, pension, sell of livestock, sale of livestock products, business, casual labour and remittance and gifts. Table 3 below shows the percentage contribution of different source to the total annual respondents' cash flow. Sell of agricultural products play an important role in sustaining livelihoods in the IBA.

Maasai community who live in Mau- Narok were known to be pastoralists (30.3%) but it seems they are breaking the norm by involving themselves with wheat, barley and potato farming which the locals claim is more profitable compared to keeping livestock (50%).

Table 3: Sources of income

Sources of income	Molo		Mau-Narok	
	Frequency	Percent	Frequency	Percent
Agricultural products	54	62.8	33	50.0
Employment	9	10.5	8	12.1
Pension	2	2.3	1	1.5
Business	16	18.6	8	12.1
Livestock	16	18.6	20	30.3
Livestock products	34	39.5	21	31.8
Casual labour	5	5.8	6	9.1
Remittance and gifts	1	1.2	5	7.6

Land ownership

Land in the study area is mainly owned by the head of the household. The land size owned by a single person ranged between 0.25 acres and 40 acres in Molo and 1 acre to 200 acres in Mau-Narok with means of 4.81 and 27.69 respectively. Mau-Narok has larger averages of land covered by natural grass. This indicates that large tracks of grassland still exists in Mau-Narok compared to Molo. Reduced land size owned by household can be attributed to increased population and household partitioning. Mau- Narok had the highest mean of acreage which is under natural grass compared to Molo. This is attributed to the fact that people living in Mau-Narok are mainly Maasai who keep livestock and therefore they use the natural grass to feed their livestock.

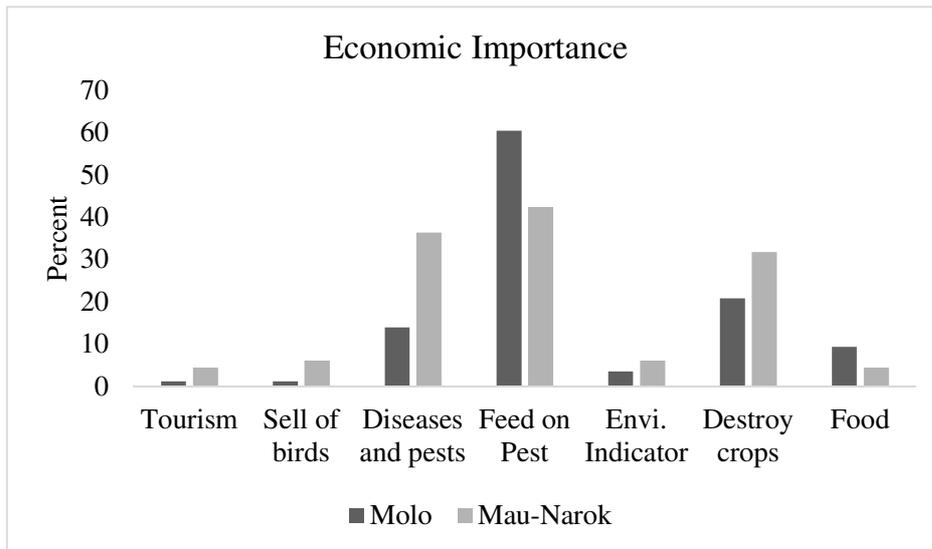


Figure 5: Economic Importance of birds

Local perception of the cultural and economic importance of birds

Majority of residence in Mau- Narok (40.9%) agrees that they hunt birds for aesthetic, used as a religious symbol (33.3%) and birds being a source of bad omen (24.2%). A few people still in this area (12.1%) agree that they use bird’s feathers and (7.6%) keep them as pets for cultural purposes. In Molo, majority of the respondents (31.4%) agree that birds are source of bad omen while 10.5% use their feathers for cultural purposes. Also, 9.3% agrees that they use birds for aesthetic through hunting while 8.1% view them as a religious symbol and a small proportion of respondents keep birds as pets for cultural practices.

Of those respondents who saw birds as economically important, the most important reason given was same across the two regions. Respondents from Molo and Mau-Narok agreed that the most economic importance (42.4% and 60.1% respectively) of birds was that they feed on pests.

Other economic factors in order of their importance include: cause diseases, destroy crops, source of food, environmental indicators, source of income through selling and tourism as shown in the figures below.

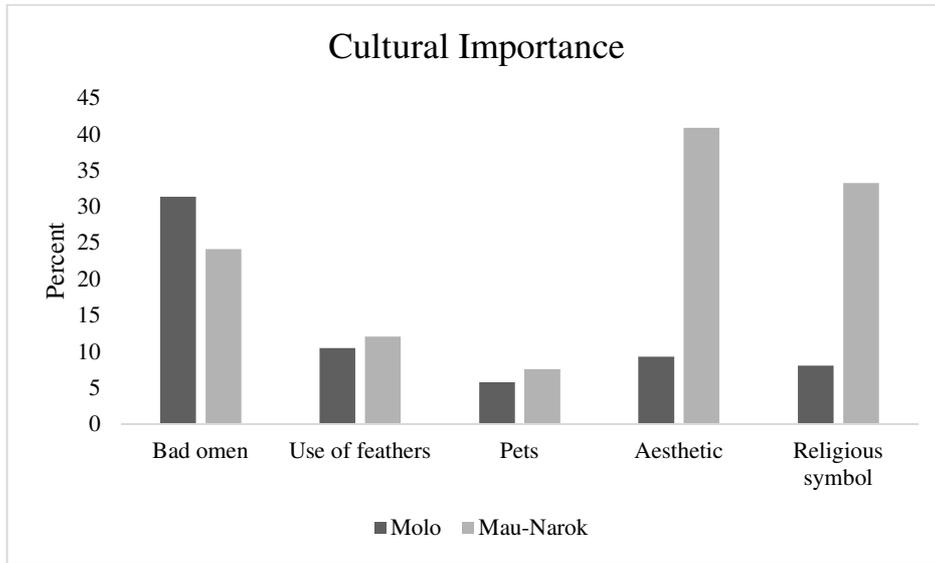


Figure 6: Cultural Importance of birds

Very few respondents participate in any kind of conservation activities. 13.2% participate occasionally in conservation while 78.9% don't participate at all in conservation activities. Conservation work in this IBA needs to be initiated as well as awareness creation so as to save the IBA and the threatened bird species inhabiting the area.

Also, majority of the respondent (62.7% in Molo and 51.5% in Mau-Narok) think that it is important to conserve habitat for unique wildlife.

Table 3: Importance of conserving habitats for unique wildlife

	Molo		Mau-Narok	
	Frequency	Percent	Frequency	Percent
Very helpful	52	62.7	34	51.5
Helpful	16	19.3	17	25.8
A little helpful	6	7.2	11	16.7
No idea	9	10.8	4	6.1

Threats facing the Mau-Narok Molo grassland IBA

Grasslands remain one of the least conserved habitats in the world. Globally just over 7% of the grasslands fall into protected areas with the world's least conserved biome being the temperate grasslands where less than 0.69% of grasslands are protected (Henwood, 1998). The study area was designated within human dominated landscapes therefore it does not receive any formal protection.

The main source of income in the study area is farming, though in Mau- Narok livestock keeping has been dominant, however the survey shows that they are abandoning the practice for cultivation which is a major threat to grasslands and the threatened birds which depends entirely on the grassland.

Three quarters of the respondents (80%), think that the major cause of grassland decline is cultivation while 21.1% said that the grasslands are diminishing due to human settlement and overgrazing. 17.8% of the respondents attributed decline of grassland to fires. Afforestation (5.3%) and soil degradation (2.0%) was listed as the least threats by the respondents.

It was noted that large tracks of grasslands only existed along the valleys, swampy areas and along the water course which was similar to previous surveys done in the area (Ndang'ang'a et al., 2003; (Malaki and Mwanika 2007). This is probably because cultivating such areas is difficult and heavy machines can't access such areas and also crops cannot grow well in water-logged areas.



Plate 1: Photo showing how crop cultivation continues to threaten the remaining grassland

Also grass tracks had been subjected to burning and we managed to ask some of the locals the reason why they are burning the grass. The main reason was to give room for fresh grass which can be consumed by the livestock and another reason was to reduce pests which cause diseases to livestock. Some fires also catch fire accidentally during land preparations for cultivation since it is mainly done during the dry months.



Plate 2: Massive burning of grasslands during dry season



Plate 3: Grassland along the valleys. Not suitable for threatened birds.



Plate 4: Livestock grazing on the remaining grasslands



Plate 5: A recent grassland converted into farmland

The above photo shows a parcel of land in Mau-Narok which was covered by natural grass during the first visit only to find it already ploughed four weeks later. This shows how grasslands are being converted at high rates in the study area.



Livestock grazing is also putting a lot of pressure to the grassland since the increasing number of livestock are forced to feed on the remaining grasslands which are reducing in size.

A total of 1,321 cows, 23 donkeys, 1,163 sheep and 334 goats were counted during the bird survey within the sample plots. Livestock were found in more than 27 sample plots meaning that at any given time, livestock are feeding on the remaining grasslands.

Local institutions in Mau Narok-Molo grassland

Local institutions and governance that deal with conservation in the study area are very few. Conservation of plants (trees) and habitat is being given attention by a number of organizations i.e. Kenya Forest service (2%), Baraka College (0.7%), environmental soldiers (0.7%) and Ministry of Health (0.7%). There is no organization carrying out conservation activities that deals with birds, mammals, reptiles, amphibians, insects and community awareness in the study area.

Site Support Groups need to be formed so as to create awareness to the locals on how important the IBA is so as to save the birds and other wildlife that inhabit this highland grassland. The locals were friendly and showed interest on knowing more about the threatened birds and this can create a platform for conservation activities in the area.



Plate 7: Kids who were herding during the survey

List of other species recorded during the survey

Species	Scientific Name	No.
Wing-snapping Cisticola	<i>Cisticola ayersii</i>	66
Plain Martin	<i>Riparia paludicola</i>	56
Common Waxbill	<i>Estrilda astrild</i>	53
Red-capped Lark	<i>Calandrella cinerea</i>	48
Grassland Pipit	<i>Anthus cinnamomeus</i>	40
Streaky Seedeater	<i>Crithagra striolata</i>	36
Stout Cisticola	<i>Cisticola robustus</i>	35
Common Fiscal	<i>Lanius collaris</i>	29
Common Stonechat	<i>Saxicola torquatus</i>	29
Common Quail	<i>Coturnix coturnix</i>	27
Black-winged Plover	<i>Vanellus melanopterus</i>	26
African Snipe	<i>Gallinago nigripennis</i>	24
Baglafaecht Weaver	<i>Ploceus baglafaecht</i>	24
Cattle Egret	<i>Bubulcus ibis</i>	24
Hadada Ibis	<i>Bostrychia hagedash</i>	21
Hunter's Cisticola	<i>Cisticola hunteri</i>	17
Grey Crowned Crane	<i>Balearica regulorum</i>	16
Speke's Weaver	<i>Ploceus spekei</i>	16
Black-headed Heron	<i>Ardea melanocephala</i>	15
Crowned Plover	<i>Vanellus coronatus</i>	14
Kenya Rufous Sparrow	<i>Passer rufocinctus</i>	12
Cape Rook	<i>Corvus capensis</i>	11
Mosque Swallow	<i>Cecropis senegalensis</i>	9
Augur Buzzard	<i>Buteo augur</i>	8
Village Weaver	<i>Ploceus cucullatus</i>	8
African Citril	<i>Crithagra citrinelloides</i>	7
Brimstone Canary	<i>Crithagra sulphurata</i>	7
Northern Anteater Chat	<i>Myrmecocichla aethiops</i>	7
Mottled Swift	<i>Tachymarptis aequatorialis</i>	6
Yellow-billed Duck	<i>Anas undulata</i>	6

Greater Blue-eared Starling	<i>Lamprotornis chalybaeus</i>	5
Red-knobbed Coot	<i>Fulica cristata</i>	5
Black Crake	<i>Amaurornis flavirostra</i>	4
Speckled Mousebird	<i>Colius striatus</i>	4
African Black-shouldered Kite	<i>Elanus caeruleus</i>	3
Black Saw-wing	<i>Psaldiprocne pristoptera</i>	3
Common Bulbul	<i>Pycnonotus barbatus</i>	3
Pied Crow	<i>Corvus albus</i>	3
Pied Wheatear	<i>Oenanthe pleschanka</i>	3
African Black Swift	<i>Apus barbatus</i>	2
African Pied Wagtail	<i>Motacilla aguimp</i>	2
Cape Robin Chat	<i>Cossypha caffra</i>	2
Cape Wagtail	<i>Motacilla capensis</i>	2
African Wattled Plover	<i>Vanellus senegallus</i>	1
Ayres's Hawk Eagle	<i>Aquila ayresii</i>	1
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>	1
Blacksmith Plover	<i>Vanellus armatus</i>	1
Bronze Sunbird	<i>Nectarinia kilimensis</i>	1
Egyptian Goose	<i>Alopochen aegyptiaca</i>	1
Holub's Golden Weaver	<i>Ploceus xanthops</i>	1
Long-crested Eagle	<i>Lophaetus occipitalis</i>	1
Martial Eagle	<i>Polemaetus bellicosus</i>	1
Olive Thrush	<i>Turdus olivaceus</i>	1
Red-billed Oxpecker	<i>Buphagus erythrorhynchus</i>	1
Red-rumped Swallow	<i>Cecropis daurica</i>	1
Sacred Ibis	<i>Threskiornis aethiopicus</i>	1
Speckled Pigeon	<i>Columba guinea</i>	1
Tropical Boubou	<i>Laniarius aethopicus</i>	1
White Stork	<i>Ciconia ciconia</i>	1
White-eyed Slaty Flycatcher	<i>Melaenornis fischeri</i>	1
White-rumped Swift	<i>Apus caffer</i>	1
Yellow-throated Longclaw	<i>Macronyx croceus</i>	1

Photos of the three main Birds.



Sharpe's Longclaw



Sharpe's Longclaw



Male Jackson's Widowbird



Lekking area



Female Jackson's Widowbird



Aberdare Cisticola



Aberdare Cisticola

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