Mountain nyala in the blink of extermination in the Arsi and Ahmar mountains of Ethiopia

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Abstract

Mountain nyala is a magnificent antelope endemic to the Ethiopian highlands east of the rift valley. With this study, we assess the conservation status of the mountain nyala in the Arsi and Ahmar mountains, the only range of the species other than the Bale mountains which is home for the largest mountain nyala population estimated about 3800 individuals. The relative abundance and population estimate was carried out based on Pellet-group counts on random plots. Habitat types were classified from 10m resolution SPOT image using ERDASS software. The mountain nyala population size in the Arsi and Ahmar mountains is greatly reduced and some of the historical populations exterminated. There is extensive habitat degradation, uncontrolled burning and high livestock abundance though out the mountain nyala range. Mountain nyala populations are restricted to isolated patches in the middle of extensive human settlement for a total of 228 km^2 area in five localities. The total mountain nyala population in the region is estimated for about 294 individuals. Trophy hunting in the regions appeared to contribute very little for the conservation of mountain nyala and fail to protect threats of mountain nyala including habitat loss and livestock grazing. While the trophy hunting in the Bale mountains, Odobullu and Abasheba Demero, may contribute for mountain nyala conservation, its contribution for the conservation of the species in the Arsi and Ahmar mountains is very little. Evaluation of the level of habitat protection by the trophy hunting also should be considered in renewing licenses and allocating quotas of hunting.

Keywords: Mountain nyala, conservation status, population decline, Arsi and Ahmar mountains

The charismatic mountain nyala (*Tragelaphus buxtoni*) is an endemic flagship species for the Ethiopian highlands that is now limited in its distribution to the Bale, Aarsi and Ahmar mountains. Brown estimated the mountain nyala population between 7000 to 8000 individuals and may be as high as 12,500 during 1968 (Brown 1968). Since then, no comprehensive study for estimating the total population has been carried out. The largest mountain nyala population in the Bale mountains estimated for about 3800 individuals recently, while the rest of the

population in the Arsi and Ahmar mountains remains unknown. Malcolem and Evangelista (2005) based on their brief survey, counts from Ethiopian Wildlife conservation Authority estimated the population size of the Arsi about 980 individuals during 2005 (Kuni Muktar 200, Din Din100, Arba Gugu, 350, Munessa 200 and Arsi 130; Fig 1). Similarly, Evangelista (2006) estimates at least 780 individuals (Munessa 330, Galama Mountains100 Kuni-Muktar, Din Din and Arba Gugu 350) not including some of the known mountain nyala population in the region.

Methods:

With this study, we provide an assessment of the mountain nyala population using Pellet-group counts count method which has been used to estimate the abundance and population size of the species in the Bale mountains (Atickem et al., 2011). The study area was designed by using 90m Digital Elevation Model in Arc GIS 10.2 by delineating potential landscape of mountain nyala (i.e. 1800 m.a.s.l.) east of the rift valley excluding the Bale mountains which results 19,984 km^2 landscape (16,783 km^2 for Arsi mountains and 3, 201 km^2 Ahmar mountains (Chercher Mountains); Fig 1).

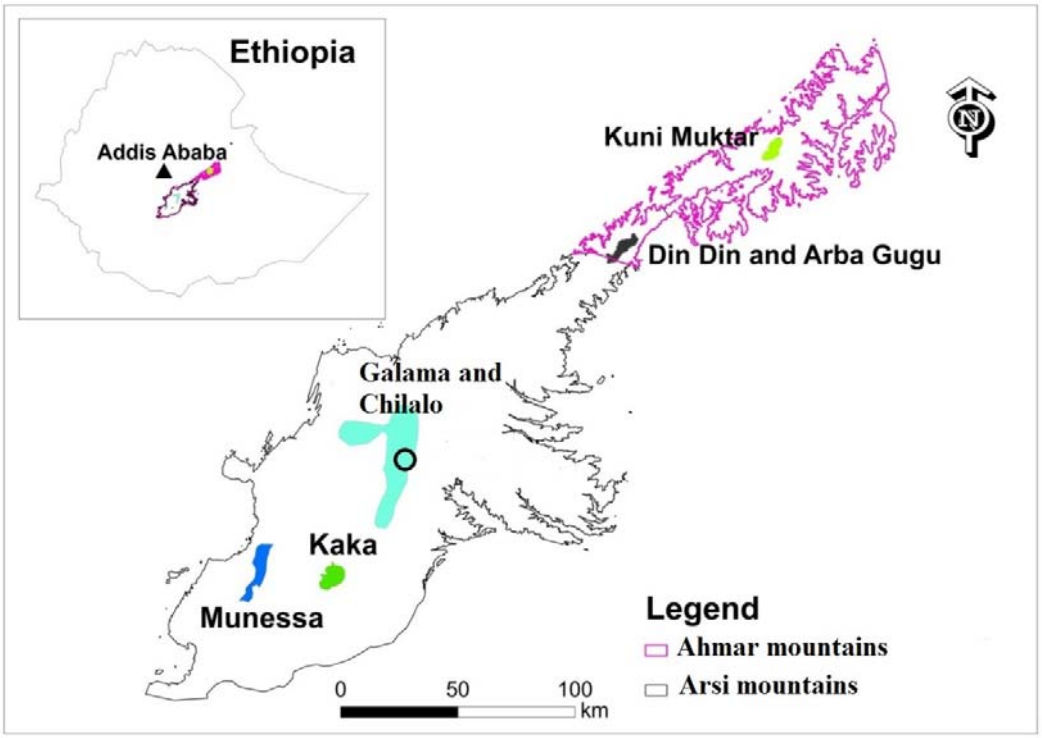

Fig 1. Mountain nyala distribution pattern in the Arsi mountains

A 10m resolution image was used to classify the major habitat types (Human influenced areas (Human settlement and agriculture), Erica shrub, forest, grassland and bushlands) by supervised classification by using ERDAS Imagine software (ERDAS, 1998). A 90m resolution Digital Elevation Model is used to determine the slope and elevation value of the landscape using Arc GIS 10.2. By excluding human influenced areas (human settlement and agriculture; Fig 2), we surveyed the mountain nyala potential ranges which is about 2,318 km2 area . We combine with questionnaire survey with the local people if the mountain nyala existed in their surrounding area during the survey.

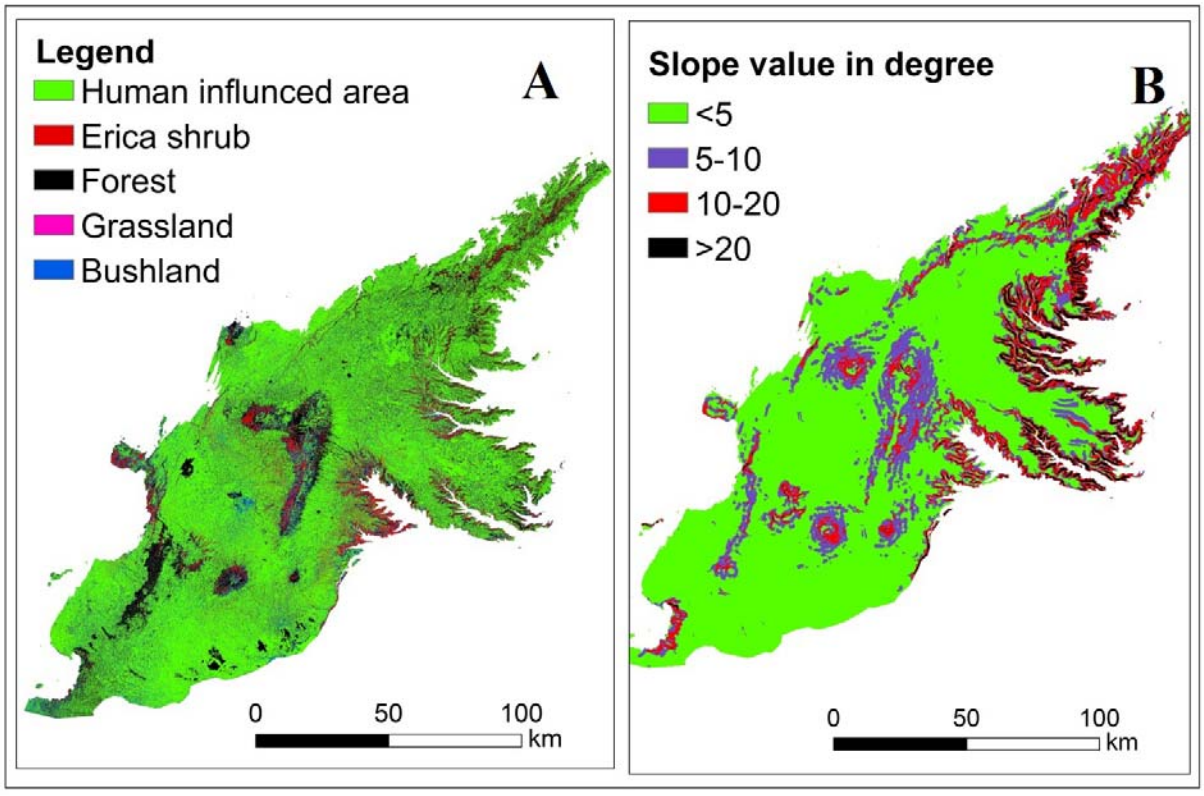

Fig 2. Arsi massify landcover and slope varition

Across the mountain nyala localities, core area of the species was delineated by taking the boundary of the area using Global Positioning system. About 1.5 plots of 4*5 m^2 area were established per Km^2 of each of the localities on random locations and mountain nyala Pellet-group counts were counted in each plot (Atickem et al., 2011). The Pellet-group abundance index (PAI), number of Pellet-group per plots was calculated for estimating relative abundance

of mountain nyala in the range. A population estimate of mountain nyala was carried out by using Pellet-group counts. With this method, density of animals will be calculated as Da= Ds/Pi*I, where Da= Density of the animal, Ds= Total number of Pellet-group encountered per area, Pi= Mean time to decay of the Pellet-group counts and I= Rate of production of Pellet-group counts (Murray et al., 2002). Estimates of defecation and degradation rate of Pellet-group counts was used from the previous study of mountain nyala population estimate in the adjacent Bale mountains (22.3 Pellet-group counts groups per day per animal and decay rate with 34.5 days for open habitat and 44 days for areas with cover during the wet season; Atickem et al., 2011). Mountain nyala hunted by trophy hunting was obtained from records of Ethiopian Wildlife Conservation Authority.

A 2m resolution SPOT image of the Galama mountains which is about 720 km^2 retrieved during the time of uncontrolled fire was used for estimating the Erica burned.

Results

About 82% of the Arsi and Amhara mountains is dominated by human influence (Human settlement and agriculture; Fig 2A). The larger proportion of the landscape (67%) is level (< 5 degree of slope) and 88.4% of the landscape is below 3000 masl that makes the landscape an ideal for crop cultivation. The Arsi highland is in fact main source of wheat which is the second staple food in Ethiopia next to teff (Hailu, 2003). The remnant forest and Erica shrubs are restricted to the rugged terrain of the region (Fig 2) and hence the mountain nyala populations (Munessa, Kaka, Galama and Chilalo, Arba Gugu, Din Din and Kuni-Muktar; Fig 1). Unlike the mountain nyala range in the Bale mountains where extensive forest in eastern escarpments, the mountain nyala population in the Arsi and Ahmar mountains are small islands surrounded by extensive human settlement and agriculture. The mountain nyala core area in the region for the five localities is only 228 km^2 area ranged between 25 and 113 km^2 area (Table 1) which makes sensitive for further habitat loss and effects of livestock grazing.

The PAI in the Arsi and Amhar regions showed a very low abundance of mountain nyala when compared to the Bale mountains (Atickem et al., 2011: Table 1). We estimated the population size of 294 individuals across the range and the only promising habitat left for the species is the Munessa mountains which is home for about 115 individuals with forest size of 75

km2 area. The absence of any Pellet-group from the Kakka and Chillalo mountains which was once largest mountain nyala population of the region (Brown 1969) represents a sharp decline of the species in the region. In Din Din, Arba Gugu and Kuni-muktar, the habitat is degraded but the rugged terrain contributes for maintaining mountain nyala habitat in patchily. With the mountain nyala population estimated 3,800 individuals in the bale mountains (Atickem et al., 2011), the global mountain nyala population estimate will be 4094 individuals.

Table 1. Mountain nyala population estimate in the Arsi and Ahmar mountains

Locality	Range	No Plots	PAI	Mountain nyala Estimate
Munessa	113	152	0,031	115
Kaka	26	39	0,000	0
Galama and Chilalo	42	63	0,017	62
Arba Gugu and Din din	60	90	0,023	80
Kuni-Muktar	25	38	0,018	37
Total	266	382	-	294

The livestock abundance is high though out the mountain nyala localities (Fig 3). With already reduced population size and isolated small patch of the mountain nyala habitat, the potential negative impacts of livestock grazing is clear. Mountain nyala has been classified as a browser (Yalden & Largen, 1992; Gagnon & Chew, 2000) and therefore should be less affected by livestock grazing, studies in the northern grassland of Bale mountains reveal mountain nyala is a mixed feeder and females more towards grazing (Atickem and Loe, 2013). This makes mountain nyala sensitive for livestock grazing pressure and studies already showed livestock grazing can affect the species existence (Atickem and Loe, 2013; Mamo and Bekele, 2011).

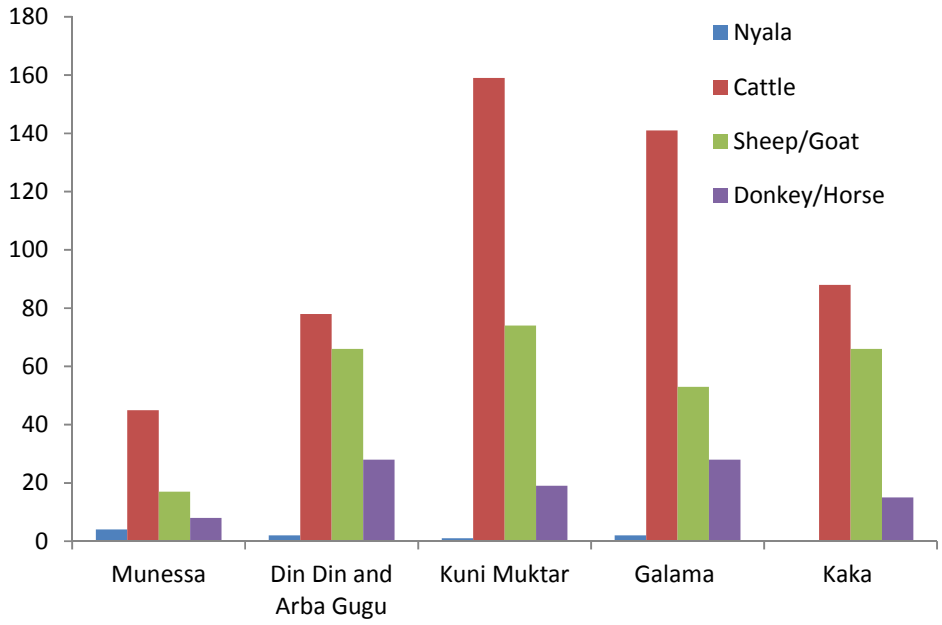

Fig 3. Mountain nyala and livestock abundance in the core mountain nyala habitats of the Arsi and Amhar mountains.

The other threat in the Arsi and Ahmar mountains is fire mainly initiated by the local people for getting fresh forage for their livestock and eliminating large carnivores that potentially can attack livestock. While fire can have positive and negative effects in a given ecosystem depending on a number of ecological factors, the uncontrolled fire is devastating for the mountain nyala which took a refuge in small isolated patches of forest/Erica habitats. Fires destroy the critical remaining resource of mountain nyala in the dry season when resources are critically low and can kill mountain nyala itself. The Galama Mountains which is about 720km 2 highlands has been under fire though out its range that destroys 46% of the Erica shrubs (Fig 4). Galama mountains where mountain nyala first reported during 1908 (Lydekker, 1910) was one of the largest mountain nyala population during the 1969 survey by Brown 1969.

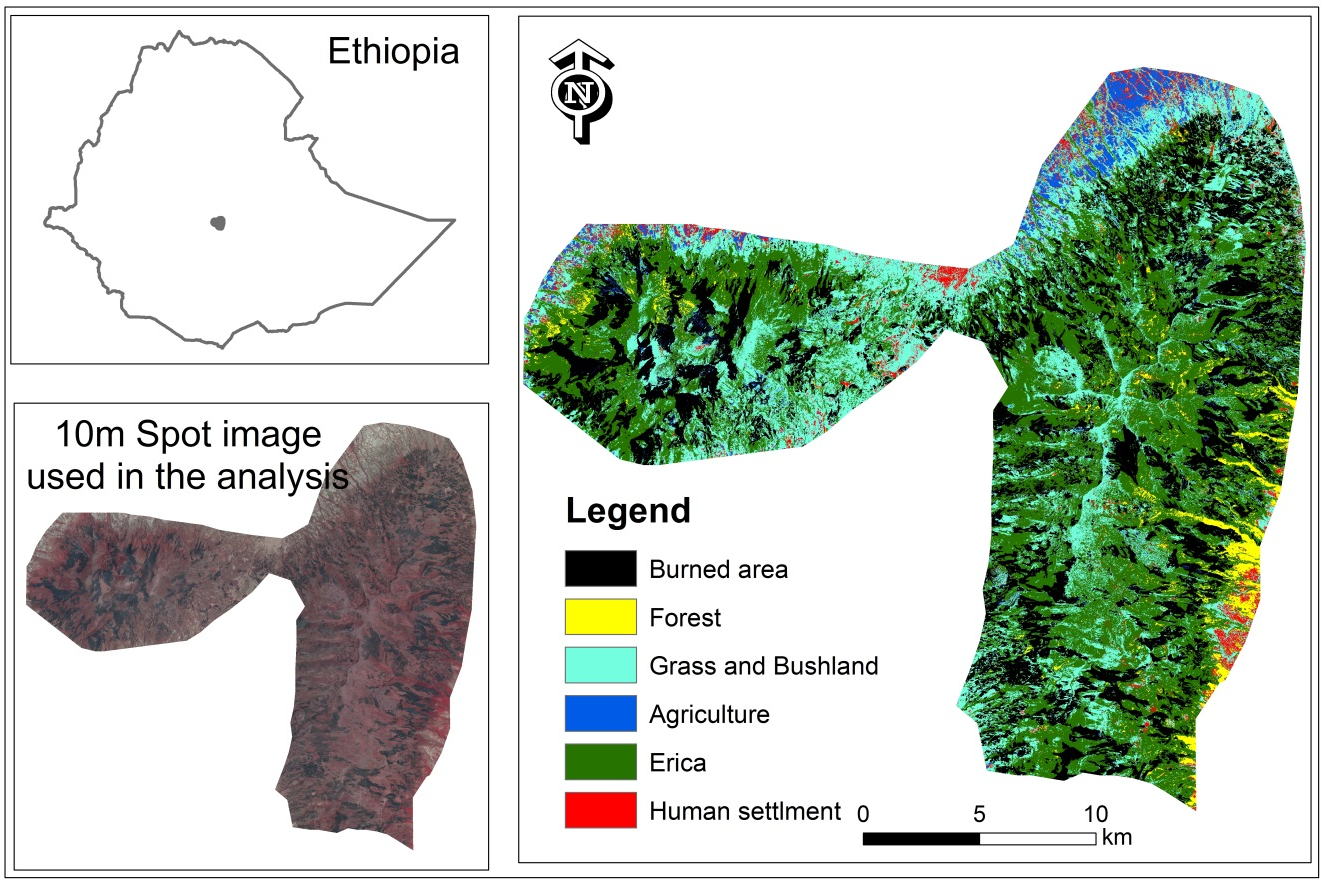

Fig 4. A 720 km2 area of the Arsi mountains under fire

Trophy hunting has been advocated as a tool for wildlife conservation that provides monetary incentives for conservation. Trophy hunting is mentioned to play a key role in the recovery of white rhinoceros (*Ceratotherium simum*) (Leader-Williams & Hutton 2005) and has facilitated the rehabilitation of the Coutada hunting areas in Mozambique (Lindsey 2005). However, there is a lack of consensus among conservationists as to whether trophy hunting represents a legitimate conservation tool in Africa (Gordon et al. 2004; Whitman et al. 2004; Lindsey et al., 2006; Loveridge et al., 2006). In the Arsi and Ahmar mountains, at least 82 males were hunted within 8 years between 1990 and 1998 (39 in Arba Gugu, 10 in Din Din, 11 Gallama mountains and 22 males in Munessa). The area is historical for trophy hunting since the discovery of the species. Acording to Evangelista 2007, By the 1980s, safari hunting was loosely regulated and hunting only required a license and an accompanying game scout with no annual quotas. While no record is found for details, the mountain nyala population in the region has been under trophy

hunting concessions. With the current degraded habitat and small mountain nyala population, it is apparent that such substantial number of trophy hunting has little effect on the conservation of the species. The appealing high conservation value of the mountain nyala in the region (Evangelista 2006) should be revised for a better management strategy. While the long term effects of the trophy hunting needs to be studied based on the population dynamics and breeding success of the population, the trophy hunting concession of the Abasheba Demero and Odobullu is the best protected habitat of mountain nyala supporting the largest mountain nyala population of the globe with nearly no livestock abundance (Atickem et al., 2011; Atickem and Loe, 2013). This paradox is resulted due to the difference in management system between the trophy hunting companies. Livestock density and habitat quality in different mountain nyala hunting concessions studied here and Bale mountains (Atickem et al., 2011; Atickem and Loe, 2013). The Ethiopian Wildlife Conservation Authority (EWCA) conducts yearly monitoring to assess the nyala population size which will be used as base for quota allocation (Evangelista 2007), here we recommend to consider to what extent the trophy hunting companies protect the concessions from human influence and livestock grazing.

Conclusion

Mountain nyala population in the Arsi and Amhar mountains is in the blink of exitiction with about 294 individuals under increasing presure of habitat loss, livestock grazing, uncontroled fire in isolated small parches as last stand. Many large historical large mountain nyala populations are exterminted. The mountain nyala population in Arsi is genetically distinctive (Atickem et al., 2013) which makes it even more valuable for conservation beside the small population size of the species in general. The uncontrolled fire is a significant threat for the mountain nyala and the whole ecosystem of the Ethiopian highlands. The reasons behind the fire and protective measures to protect fire from spreading needs to be understood and protected. While trophy hunting may contribute for the conservation of mountain nyala in the Odobullu and Abasheba Demero of the Bale mountains, it is apparent failure for the population in the Arsi and Amhar mountains. We strongly recommend the inclusion of habitat quality control in the lease agreement between the Ethiopian Wildlife Conservation Authority and trophy hunting companies.

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