**2013 ANNUAL PROGRESS REPORT: HIROLA CONSERVATION PROGRAM**

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**Summary**

The Hirola Conservation Program (www.hirolaconservation.org) promotes the conservation of the endangered hirola antelope (*Beatragus hunteri*) and its fragile habitat in partnership with local pastoralist groups in eastern Kenya. The program was established in 2008 as a small grassroot project but only picked up in 2011 to address the urgent need to conserve the hirola antelope in the community rangelands. Our vision is to establish and sustain a conservation program to make lasting contributions to the future of hirola antelope and of local communities within the hirola's geographic range. The first phase of the program focused on hirola scientific research with special emphasis on demographic drivers of hirola declines, resource selection, and landscape change. Funding through our partners was valuable in designing and executing this research project that consists of four primary goals. First, we are relating geographic range collapse of hirola to overgrazing and elephant extirpations using long-term aerial surveys and Landsat satellite imagery of Ijara. Secondly, we are conducting population viability analyses (PVA) to quantify the relative impacts of predation and range quality on hirola pregnancy, birth rates, recruitment, and survival. We have conducted a population viability analysis of hirola based on historic aerial surveys to forecast likelihood of extinction 10, 50, and 100 years into the future. Thirdly, we are investigating resource selection of hirola based on range quality and predator abundance to identify potential release sites for future reintroductions. Fourth, we are fostering long-term hirola conservation through community education and outreach.

***One of the GPS collared hirola females in Ijara, Kenya***

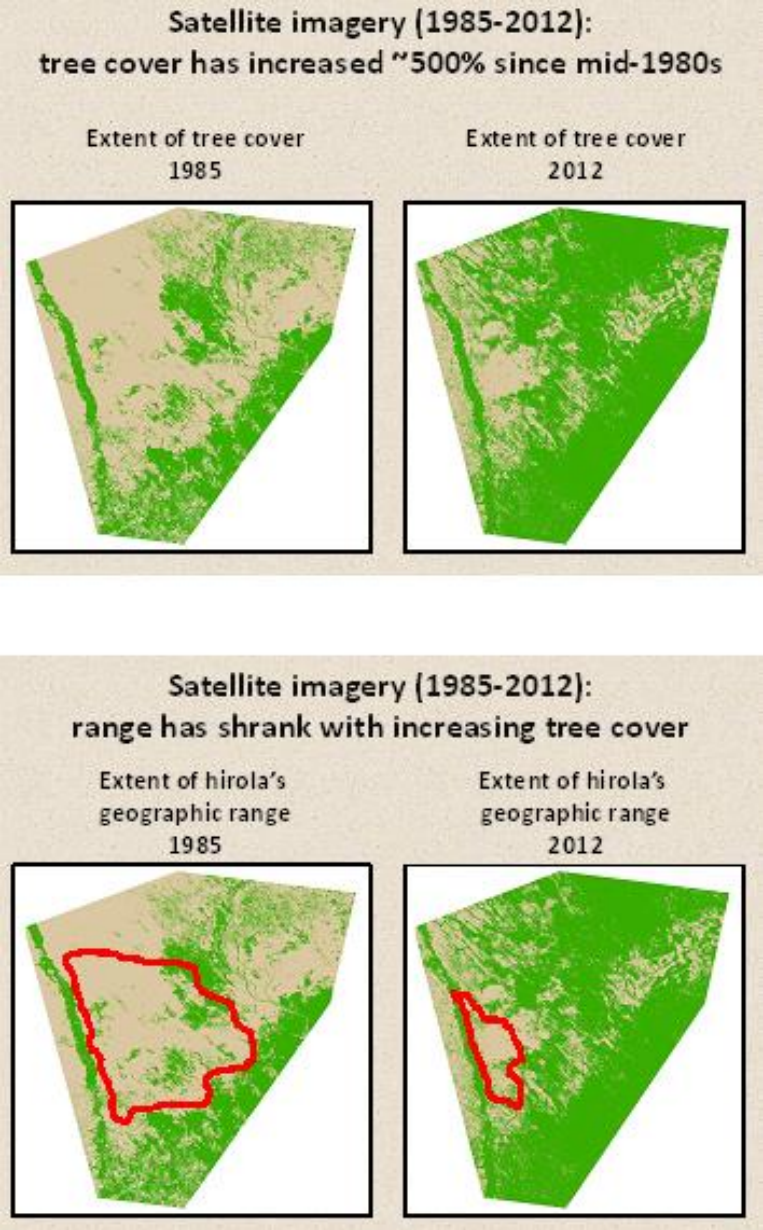
The majority of Goals #1 and #2 also has been completed successfully and are at the manuscript stage. Goals #3 and #4 are on-going; currently, we are collecting data on the survival and movements from nine hirola between the Tana River and Boni Forest to which we fixed GPS collars in August and December 2012. This was a major, unprecedented effort requiring coordination among our field team, the Kenya Wildlife Service (KWS), and tribal groups in Ijara. These nine individuals represent seven herds and once per month, we visually locate these herds generating information on age structure, recruitment, and survival. We are using this demographic data as a control in comparison to a population of hirola recently translocated to a predator-proof sanctuary in Ishaqbini Community Conservancy. In addition, we are using movement data from these nine individuals to identify suitable habitats for future reintroductions. We recently completed administering questionnaires on management options to quantify and compare levels of support for a series of range management interventions to be implemented in the future.

Since the inception of the project, we contributed popular publications to several media outlets including IUCN Gnusletter, Swara, AZA's Connect magazine, and local FM radio stations in the region. In this regard, we have tried to raise awareness and promote better appreciation for hirola within Kenya and in the international community.

In 2014, in collaboration with our international partners we are scaling program activities through a series of phases that build on each other. The next phase of this program will focus on training and employment of communities to protect and monitor the species; habitat restoration and protection, support of education for pastoral children; awareness campaigns. The second phase will focus on partnering on research projects that link directly to management; and rangeland rehabilitation through planned livestock grazing. The third and fourth phases of the program will target tourism development and diversification of community livelihoods. All this will be integrated into the conservation action plan we are developing for area wide hirola conservation. In order to maximize the success of its programs, coordination and close collaboration with partner organizations working in hirola conservation is a priority of the project.

**Specific research outcomes and progress**

**1: CAUSES OF LANDSCAPE CHANGE AND RANGE COLLAPSE OF HIROLA IN NORTHEASTERN KENYA**




Remote sensing provides a powerful tool to monitor land cover changes at different scales. To understand the effect of overgrazing and elephant extirpation on range collapse of hirola, we have trained and classified Landsat images of Ijara District (1985 to 2010) to effectively provide a 27-year time series of changes in tree cover and understory (forage) abundance (Figure 1). For each image, we trained and classified remotely-sensed data into four classes: 1) tree cover; 2) understory cover; 3) cloud; and 4) shadow. We then combined both clouds and shadows into a "no data" class and using conditional statement in ArcGIS; we have filled in missing data with values from corresponding images with a similar acquisition date. We are using Random Forests to run a change detection analysis as applied in R (R development core 2013). Through these efforts in imagery classification, we are linking hirola declines to range degradation via tree encroachment.

**Figure 1: Bush trends in the hirola range in 1985 and in 2010. Green represents treecover and brown represents grasslands. Note the stark decrease in grassland between 1985 and 2010.**

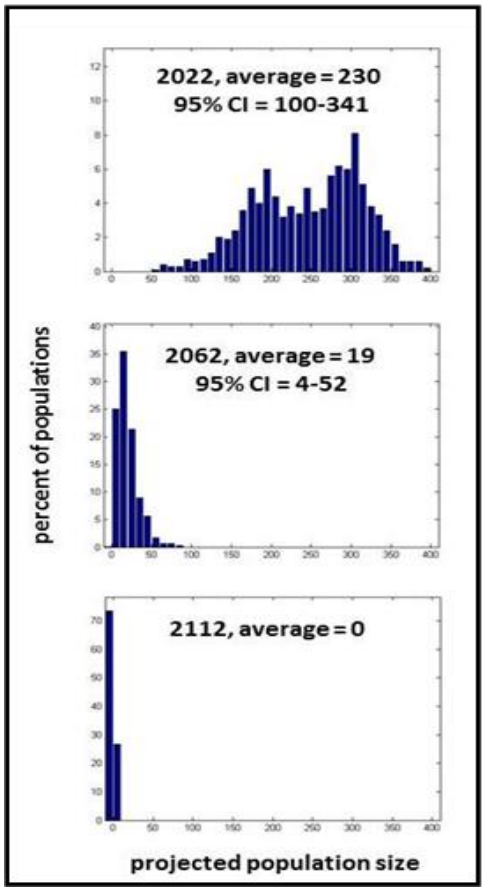



**Figure 2: Results of population viability analysis of hirola aerial counts from 1978-2011. Graphs depict average and 95% confidence intervals of projected population size for hirola 10, 50, and 100 years.**

## 2: DEMOGRAPHIC DRIVERS OF HIROLA POPULATIONS IN IJARA DISTRICT

Using data collected from aerial surveys conducted between 1977-2011 (Kenya Department of Remote Sensing and Resource Surveys and Northern Rangelands Trust, unpublished data), we conducted a count-based population viability analysis of hirola to forecast likelihood of extinction 10, 50, and 100 years into the future. From these analyses, and in the absence of management interventions, we predict global extinction in the next 50-100 years (Figure 2). In light of this prediction, and with the help of our partners, we are currently working to understand the factors responsible for hirola declines, and identify viable management options to curtail these declines.

Since January 2011, we have been monitoring hirola demography throughout Ijara District. We are focusing on hirola herds under three different scenarios.

Setting 1) INSIDE PREDATOR-PROOF SANCTUARY, INSIDE ISHAQBINI. This setting is characterized by high-quality range and absence of predators.

Setting 2) OUTSIDE PREDATOR-PROOF SANCTUARY, INSIDE ISHAQBINI. This setting is characterized by high-quality range and high abundances of wild dogs, lions, and other predators.

Setting 3) OUTSIDE PREDATOR-PROOF SANCTUARY, OUTSIDE ISHAQBINI. This setting is characterized by low-quality range and high abundances of wild dogs, lions, and other predators.

By comparing hirola demography in these three settings, we will assess the relative impacts of predation and range quality on hirola demography.

## 3: UNDERSTANDING RESOURCE SELECTION AND MOVEMENTS OF HIROLA TO INFORM FUTURE REINTRODUCTIONS

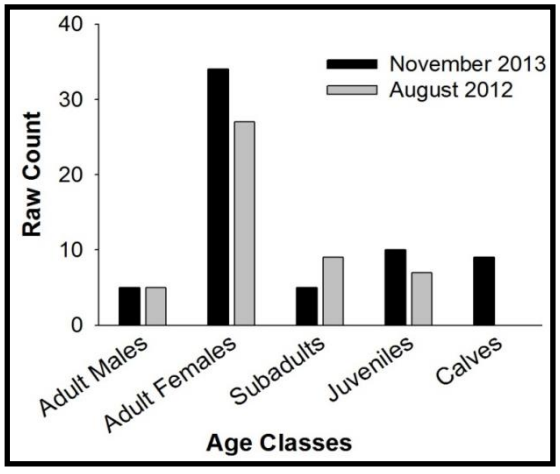



**Figure 3: Population structure in the sanctuary.**

In December 2012, and with the help of our partners, we captured nine adult females (>3 years old) from herds at the periphery of this species' historic geographic range in Arawale and the Burathagoin grazing fields of Ijara District. We fitted GPS collars on nine females from seven different herds to relocate associated individuals and to estimate demographic parameters. Our GPS radiocollars (Vectronic Aerospace) are set to record one location every one hour for 3

years. Iridium satellite communication permits us to track herds within 24 hours of movement. The radiocollared individuals can be tracked in real-time on our website (www.hirolaconservation.org)
Once per month, we relocate animals visually from the ground to record survival, recruitment, and age structure; we are comparing these data to those from herds occupying 1) a predator-proof sanctuary (Figure 3); and 2) areas with higher-quality range than Arawale and Burathagoin. For the radio-collared individuals, we will construct resource selection functions (RSFs) to quantify the extent to which particular habitat features (distance to water, distance to settlement, percent grass cover, percent forb cover, and percent tree cover) are selected for or avoided by hirola. Our RSF will be used to inform future reintroduction efforts of sanctuary-bred animals. This effort is being used to understand the relative influence of predation and range quality in driving hirola population dynamics, and will provide insight into historic declines and contemporary lack of recovery. Additionally, the data we generate on habitat selection and movements can be used to identify sites suitable for any future reintroduction efforts.

**4: COMMUNITY ATTITUDES TOWARD HIROLA CONSERVATION AND RANGE RESTORATION**

It is critical to understand the economic, cultural, social and political factors that influence attitudes towards hirola conservation. Over the past year we have assessed the ecological knowledge of Somali pastoralists by administering structured questionnaires to homesteads in Arawale, Gababa, and Ishaqbini. Through questionnaires, we have also explored the degree to which pastoralists will accept four potential management solutions: 1) ripping and reseeding large areas of range; 2) prescribed burning; 3) intensive rotational grazing; and 4) elephant reintroduction. We are analyzing survey data using classification and regression tree (CART) and will be used to inform national policy towards hirola conservation.

Our work continues to be major backbone of hirola conservation and research in Ijara, Kenya. Since we started this project, we have been engaging communities through employments, itinerant meetings, schools visits and the production of educational materials. We finalised the first manuscript of this work and two others are underway in the next two years. These papers will be the first major publications on hirola and will target high impact factor journals such as *Conservation Biology, Ecological Applications, Biological Conservation and Journal of Applied Ecology*. One of us (Mr. Ali) is am a member of the national Hirola Management Committee and we contribute our finding sthrough regular meetings progress reports. The project produces one progress annually and we also share monthly reports.

Press coverage of our work can be found here:

The Wildlife Extra
http://www.wildlifeextra.com/go/news/hirola-kenya.html#cr
The Standard (Kenya's newspaper of record):
http://www.standardmedia.co.ke/?articleID=2000035100&pageNo=1
Zoological Society of London Press Release (picked up by many international outlets):
http://www.edgeofexistence.org/edgeblog/?p=6502
The Metro UK newspaper
http://metro.co.uk/2013/01/28/endangered-antelope-fitted-with-gps-collars-3369213/
University of Wyoming News article:
http://www.uwyo.edu/uw/news/2013/01/uw-doctoral-student-partners-with-zoological-society-of-london-to-research-rare-hirola-antelope.html

In 2013, Mr. Ali was appointed to the IUCN's Antelope Specialist Group and more recently was recognized as one of the world's emerging conservation leaders by consortiums of conservation organisations in the US, including International Fund for Animal Welfare,

Defenders of Wildlife, Wildlife Conservation Society, World Wildlife Fund, and the US Fish & Wildlife Service http://wildlifeleaders.org/about/participants/class-5-2013-2014/

Also, Mr. Ali was recognized by the American Society of Mammalogists and was awarded the William T. Hornaday award (for excellence in conservation research by a graduate student) in 2013 http://www.mammalsociety.org/2013-hornaday-award-abdullahi-hussein-ali. Recently Mr. Ali was recognized by the Garissa County (Kenya) Governor's office for his going conservation effort in the area (Figure 4). All these forums are allowing us to forge ties with individuals in positions of conversation and political influence for the strengthening of hirola conservation.


**Figure 4: Mr. Ali receiving a conservation award from the governor, Garissa County, 2014**

## Conservation Implications for Hirola

Our effort provides a greater understanding of the factors underlying hirola population declines by focusing on predation and range degradation. As with many declining species, more than one factor probably underlies the plight of hirola. It is possible (and indeed, likely), that some combination of predation and range degradation is responsible for the apparent inability of hirola to recover in its native range. Documenting the relative influence of these two factors in the field holds promise as to what steps can and should be taken to maximize the chances of hirola persistence in the future. For example, if predation (or poaching) is the primary factor suppressing hirola numbers, we anticipate rates of population change to exceed 1.0 within the sanctuary, indicating positive population growth. Under this scenario, future management efforts would be well-advised to focus on some combination of 1) community education and outreach in attempt to minimize poaching; 2) training anti-poaching squads; and 3) identifying reintroduction sites where the risk of predation and/or poaching is minimal.

On the other hand, if predation (or poaching) is an important but secondary factor suppressing hirola numbers and range condition drives hirola numbers, we anticipate rates of population change to increase within the sanctuary, but below the expected rate (i.e., with predation removed). If this is the case, we would expect hirola outside Ishaqbini to exhibit lower survival and birth rates, regardless of whether they were contained in the predator-proof sanctuary. In the event of these results, future management efforts should focus on range improvement strategies (e.g., holistic management, bush clearing, etc) in outlying areas in attempt to improve habitat and bolster hirola numbers. The massive undertaking of creating and maintaining a predator-proof sanctuary to serve as a source for future reintroductions will only be successful if the major threats outside the sanctuary (i.e., in the reintroduction sites) are identified and mitigated. Of equal importance to this effort will be the use of RSFs to identify sites suitable for the reintroduction of sanctuary-bred hirola. To maximize the chances of successful reintroduction, it is imperative that stakeholders understand the landscape (distance to nearest settlement, distance to water) and vegetation (percent shrub cover, percent annual grasses, percent perennial grasses) features that hirola select or avoid so as to target reintroductions in areas that share these attributes.