Comparing Empirical with Perceived Trends in Wildlife, Livestock, Human Population and Settlement Numbers in Pastoral Systems: The Greater Maasai Mara Ecosystem, Kenya

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Abstract

Human activities are driving wildlife population declines worldwide. However, empirical understandings of their operation and consequences for wildlife populations and habitats are limited. We explored relationships between empirical and perceived wildlife and livestock population trends in Kenya using data on i) aerial monitoring of wildlife and livestock populations during 1977-2018, ii) human population censuses; and iii) semi-structured interviews with 338 male and female respondents from 250 households from four zones of the Greater Maasai Mara Ecosystem in 2019 and 2020. Wildlife numbers declined by 72.3% but sheep and goats increased by 306.4%. Yet nearly 50% of the interviewees perceived increases in wildlife numbers during 2011-2020 but concurrent decreases in livestock numbers because wildlife compete with livestock for resources. About one third of the respondents perceived an increase in the number of people living within conservancies and around the reserve and considered this indicative of a developing and thriving community. Notable discrepancies between the empirical and perceived trends were often more apparent than real and collectively suggest that incentives that promote wildlife are evidently viewed as less attractive than those that encourage increasing human and livestock numbers. Reconciling such apparent contradictions in empirical and perceived patterns is essential to extracting insights for formulating policies for sustaining livestock and wildlife populations and their habitats while promoting human welfare in grasslands.

Introduction

Grasslands host rich biodiversity and support agricultural production through livestock grazing on forage that cannot be used directly by humans. Despite the wealth of benefits offered by grasslands, human activities are driving wildlife population declines in Africa (Ogutu et al, 2011; 2014; Holechek and Valdez, 2018; Jones et al, 2018). Declines in Kenya are caused by the degradation of grasslands by anthropogenic land use change and amplified by climate change and widening variability. These processes jointly put enormous pressures on pastoralism, sedentary livestock ranching and wildlife conservation in Kenya's rangelands, including inside protected areas (Ogutu et al, 2016, 2014).

While substantial investments have been made in monitoring wildlife and livestock numbers in Kenya's rangelands, far less has been invested in the analysis and interpretation of animal population trends that incorporate perspectives of resident communities (Ogutu et al, 2016). Combining statistical trend analyses with analyses of perceptions of local inhabitants is important to enhance the formulation and implementation of appropriate policies. Here, we combine statistical analysis of wildlife and livestock population trends based on aerial survey monitoring data with analysis of community perceptions derived from interviews conducted in the Greater Maasai Mara Ecosystem (GMME). We explore the extent to which local views corroborate or contradict empirical trends derived from statistical analyses of trends in wildlife, livestock and human population numbers in the GMME.

Methods and Study Site

This study was conducted across four zones constituting the GMME (7,500 km^2, Figure 1). We adopted a mixed methods approach that combined aerial survey and human population census data with qualitative and quantitative household level data. The aerial monitoring survey data were collected from 1977 to 2018 by the Directorate of Resource Surveys and Remote Sensing of Kenya (DRSRS) on the population sizes of wildlife, livestock, and humans (Veldhuis et al. 2019). The human population censuses were conducted at the sub-locational level by the Kenya National Bureau of Statistics (KNBS) in 1962, 1969, 1979, 1989, 1999, 2009 and 2019. Interviews with both structured and open questions were administered to respondents in July 2019 and 2020 in the GMME. The interviews which were part of a larger study captured a wide range of themes. We focus on the responses on demographic and livelihood characteristics as well as local perceptions of trends in livestock, wildlife and human population sizes.

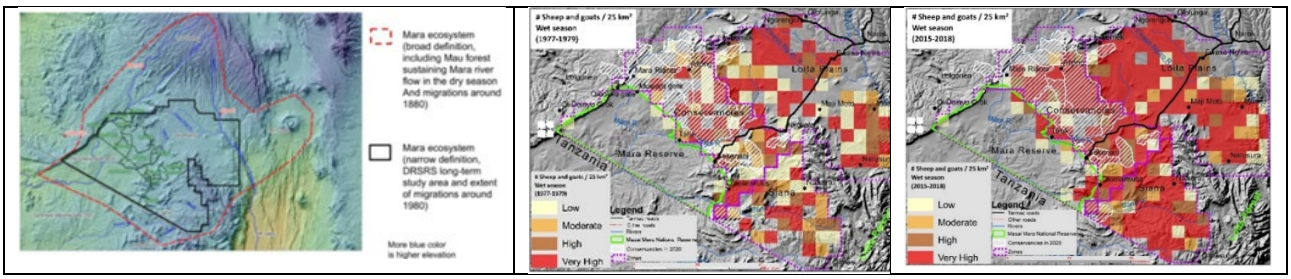

Figure 1: Map of the study zones: Maasai Mara Reserve, Conservancies, Loita Plains and Siana illustrating increase in density and range of sheep and goats between the a) 1970s and b) 2010s.

The interviews (n=338) consisted of 227 male household heads and 111 female spouses of the household heads or household heads themselves. Three of the four zones of the GMME were each partitioned into 5×5km units and one household selected randomly from each unit for interview in July 2019 and July 2020. For each unit a different household from the one interviewed in 2019 was selected for interview in 2020. Only rangers and wardens were interviewed at each of the five main entrance gates of the Mara Reserve. To account for perception differences, respondents were distributed over the four zones such that 37 were from the Mara Reserve gates, 129 from the conservancies zone, 87 from the Loita Plains and 85 from Siana. The interviews were conducted by 10 trained residents who were familiar with both the geographic terrain and spoke the local Maa language.

Results

Household Demographics

Most respondents lived in permanent homesteads, with those from Siana living on larger land parcels than their counterparts from the other three zones. Over 50% of the household heads had no formal education. The largest proportion of educated respondents were from the Mara Reserve where more females than their male and female counterparts in the other study sites had acquired a tertiary education. This difference in gendered education reflects the sample of educated female rangers which was unique for the Mara Reserve because across all the other sites, pastoralism was the most dominant livelihood type.

Livestock, wildlife, human population, and settlement trends

The aerial survey data showed that, on average, the total number of the 14 common large wildlife species (Thomson's and Grant's gazelles, impala, warthog, ostrich, waterbuck, topi, hartebeest, wildebeest, zebra, eland, buffalo, giraffe, and elephant) declined in the GMME by 72.3% from 491,368 animals in 1977-1978 to 136,364 animals in 2018. Cattle numbers also declined by 14% from 218,391 in 1977-1978 to 187,672 in 2018, whereas sheep plus goats grew exponentially by 306.4% from 165,735 in 1977-1978 to 673,606 in 2018. Many respondents (46%) perceived a decrease in wildlife populations consistent with the empirical trends, with a far smaller proportion (4%) perceiving this trend close to conservancies. Respondents attributed the declines to increased number of fences and human settlements displacing and blocking wildlife movements, as well as elevated poaching levels. However, many respondents (49%) also reported an increase in wildlife numbers during 2011-2020 contrary to the aerial survey trends, with 67% perceiving this increase within or closer to conservancies. Respondents associated the increase in wildlife numbers with enhanced conservation efforts involving intensified protection by rangers of wildlife and their habitats.

Regarding livestock, 51% of respondents perceived a decrease in cattle numbers, corroborating the aerial survey trends. Interviewees attributed the declines to shrinking of grazing land as conservancies expanded. Respondents viewed the shift in land tenure system from group to private ownership, subdivision and fencing as depriving communities of the benefits of traditional communal grazing and flexible mobility critical for cattle pastoralism. However, a substantial proportion (30%) of respondents perceived increased cattle numbers due to good livestock management, sufficient space, pasture and other resources and increased livestock purchases using conservancy land rents. Contrary to the aerial survey trends, interviewees reported a sharp decline in numbers of sheep (57%) and goats (54%) during 2011-2020. Respondents explained this by resource scarcity linked to loss of grazing land to expanding wildlife conservancies and strict enforcement of conservancy grazing rules. Respondents linked the perceived increase in goat (21%) and sheep (17%) numbers to sufficient grazing area and pasture and more income, e.g., from conservancy payments, for purchasing more or reducing sales of sheep and goats.

Most respondents held negative attitudes towards perceived increases in wildlife numbers. Interviewees viewed wildlife as occupying the space meant for livestock (67%) and roaming out of protected areas and onto private lands where both species compete for similar limited resources. Another negative perception concerned the removal or displacement of livestock keepers from protected areas which were former grazing areas. However, some respondents (27%) felt that wildlife does not occupy the space meant for livestock as fences keep wildlife out and enclose livestock inside private land. Yet other respondents even observed that few or no more wildlife remain, which more closely matches the aerial survey trends.

Both the aerial survey and interview data revealed consistent patterns of change in the number of people and settlements. The KNBS censuses showed a 315% increase in human population size from 38,451 people in 1979 to 144,702 people in 2019 whereas the DRSRS aerial survey showed that settlements increased by 110% from 66,874 in 1977 to 140,875 in 2018 similar to the household survey in which respondents observed an increase in human population and settlement (90%) numbers. Across all four zones, land privatisation was considered the major driver of sedentarisation, leading to increase in settlements. Additionally, within the conservancies and around the MMNR, respondents (96%) reported an increase in population size over 2011-2020 due to high birth rates. Population increase within the Mara area was associated by respondents (57%) to increases in businesses, employment in tourism and other sectors and to grazing opportunities in the MMNR (especially at night in the dry season). Within or near conservancies, respondents (34%) attributed population increase to employment and grazing opportunities or arrangements within conservancies. Those who reported an increase in population size near conservancies (68%) viewed this positively and stated that rights and freedoms could be exercised under private property ownership and that inhabitants could enjoy interactions as part of a community and access development opportunities.

Discussion and Conclusions

The widespread biodiversity loss and concurrent increase in livestock numbers in Africa's grasslands is troubling and is associated with increasing studies into community perceptions of wildlife. Exploring apparent discrepancies between empirical and perceived trends provides novel insights into the tensions characterizing human, wildlife, and livestock interactions in grasslands. For example, why did most interviewees report widespread livestock declines while aerial survey trends showed an exponential increase in sheep and goat numbers and a marginal decline in cattle numbers? The scale at which data are collected may explain this apparent discrepancy. The aerial survey was conducted at the ecosystem level (7,500 km^2), whereas the interviews captured household level perceptions. Per capita, Mara residents are becoming more cattle poor. Thus, for example, cattle numbers per person sharply declined from 6 (210,586 cattle/34,851 people) in 1979 to 1.5 (223,067cattle/147,702 people) in 2019. The number of sheep and goats per capita also declined from 5.5 (193,215 sheep and goats /34,851 people) in 1979 to 4.4 (635,393 sheep and goats/147,702 people) in 2019. This explains the apparent paradox of the survey respondents' perception of a decline in sheep and goats at the household level despite the exponential increase in their numbers at the ecosystem level.

Despite the high level of investment in wildlife conservation in Kenya, our results imply that payment for ecosystem services approaches may undermine overall conservation outcomes in grasslands. According to the respondents, income from conservancy payments contributed to increased livestock purchases and reduced animal sales by Mara residents seeking to maintain or expand their livestock wealth. Given finite land and other resources, our results complement emerging evidence from various studies which warn against increased pressure on grasslands from growing livestock numbers and expanding land under conservancies without careful consideration of the trade-offs for other human sustainable development goals.

A second apparent discrepancy regards the perception that wildlife numbers are increasing whereas the aerial survey trends show the opposite pattern. One explanation for this is linked to the expansion of conservancies. Since the adoption of the Wildlife Act of 2013 by Kenya's parliament, 6.36 million ha of land has been officially recognised as under private or non-state wildlife conservancies Kenya-wide, and 2.4 million ha of conservancies are proposed or are in the process of formation (KWCA, 2016). Given the exponentially increasing human population and settlement numbers established from both the household and aerial surveys, human-wildlife conflicts (HWC) are increasing, accentuating the impression that wildlife numbers have increased, especially near protected areas. Increases in human and livestock numbers are positively associated with increases in HWC in Narok county and Kenya-wide (Mukeka et al, 2019). HWC are considerably high because, over 65% of Kenya's wildlife are found outside protected areas and around 30%

in Narok County (Ogutu et al, 2016). Fencing land is regarded as one way of reducing HWC (Løvschal et al. 2017). But the rapid increase in fencing has had devastating impacts on biodiversity and ecosystem function threatening the near complete collapse of wildlife populations and flexible traditional pastoralism in this ecosystem while escalating conflicts. The drivers of fencing are not limited to minimization of livestock depredation and crop-raiding but also include active resistance against land dispossession and enhancing land tenure security (Weldemichel and Lein, 2019). The respondents also accurately perceived increases in wildlife numbers inside some conservancies as human activities displace wildlife from the unprotected parts of the GMME, despite the overall ecosystem-level decrease in wildlife revealed by the aerial surveys.

Capturing local perceptions and evaluating them against empirical trends is essential for understanding attitudes toward conservation, pastoralism and other livelihood and development goals. In aggregate, our results demonstrate that perceptions of temporal trends are scale-dependent, and that scale should be considered in interpreting such perceptions to avoid creating apparent paradoxes. They further suggest that wildlife conservation initiatives should be synergistic with incentives that enhance human welfare otherwise they risk creating trade-offs and being viewed as less attractive than conservation-incompatible incentives, such as encouraging increasing human and livestock population numbers. If human-dominated grasslands are to continue sustaining vibrant livestock and wildlife populations, then the different values attributed to wildlife and livestock should be understood, reconciled and integrated into policies. Our results additionally suggest that incentives–whether financial or otherwise-that support human livelihoods in wildlife-rich human-dominated grasslands must accompany the expansion of conservancies with socioeconomic advancement of residents to reduce the risk of poverty likely to result from replacing livestock with wildlife without providing viable alternative livelihood options and minimising resentment against wildlife conservation efforts. Such investments are however necessary even without expanding conservancies because of rapid human population increase in many grasslands, including the Mara, and simultaneous declining per capita livestock holdings.

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