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Community-Based Conservation: An Emerging Land Use at the Livestock-Wildlife Interface in Northern Kenya

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Abstract

In East Africa, an estimated 70% of wildlife populations are dispersed outside protected areas on community land. The way of life of the pastoralists, essentially support the thriving of wildlife. However, pastoralism is slowly transiting to more sedentary forms of livestock production. The region's wildlife populations future now largely depends on the conservation of habitats and migratory corridors on private and communally owned lands with competing land uses. Community wildlife conservancies are one of the approaches of decentralizing wildlife management and curbing biodiversity and habitat loss at the livestock-wildlife interface environments. Further, conservancies present an avenue for restoration of degraded grazing lands and improving pastoral livelihoods. This paper reviews the community-based conservation unfolding in northern Kenya using the case of Naibung'a Wildlife Conservancy in Laikipia County. Conservancies through land zoning and range rehabilitation have contributed to improved security of wildlife, people and their livestock. Conservancies' success depends on continued investment in vegetation recovery, grazing management, livestock marketing and benefit sharing. The perceived threats facing conservancies are pasture scarcity, cattle rustling and human-wildlife conflicts. Conservation objectives and human livelihoods in Africa are closely interlinked and lessons learnt in Naibung'a Wildlife Conservancy could particularly be useful to other similar initiatives in Africa.

Keywords: Naibung'a wildlife conservancy, conservation planning, Ewaso Nyiro ecosystem, community wildlife conservancies, livestock, pastoralism, wildlife, paper reviews

1. Introduction

In East Africa, an estimated 70% of wildlife populations are dispersed outside protected areas (PAs) on community land where pastoralism is practiced [1–3]. Unfenced and uncultivated rangelands adjacent to PAs increase the total available range resources to wildlife and enhances its long-term survival (see island bio-geographic theory by [4]). The region has several endemic species, some of which are vulnerable, threatened or endangered. Maintaining wildlife habitats on the communally owned lands is key to the conservation of region's migratory wildlife populations [5, 6]. In Kenya, more than half of the wildlife habitats are outside the protected areas and are dispersed in private and communal grazing lands. In these areas, wildlife, people, and livestock all interact and compete for the same natural resources [1–3]. The traditional pastoral approach to livestock husbandry is considered compatible with and complementary to wildlife conservation [7]. Human population increase is associated with agricultural expansion into more marginal areas that were formerly used as open communal grazing lands [8]. Consequently, these areas have been transformed into high-density rural settlements of small-scale farmers [8] engaging in cultivation and livestock grazing [8, 9]. Further exclusion of pastoralist and wildlife use is resulting from, progressive conversion of these lands into large-scale flower and horticultural farms. Open pastoral rangelands are under increasing pressure and unprecedented environmental degradation. Pastoralists' rangeland has become too restricted for traditional livestock grazing practices, forcing them to diversify livestock-based economies and agriculture [10, 11]. There is a widely acknowledged decline of African pastoral lands [10–14]. As the pressure on land intensifies, there is potential for conflicts between wildlife and people, over grazing land characterized by predation on domestic livestock and diseases transmission. Wildlife populations and their habitats have been adversely affected by these changes. In the internationally renowned Maasai Mara ecosystem, for example, populations of some herbivores were reported to have declined by nearly 60% over the last three decades [15–17].

The situation is grave across East Africa and if solutions are not sought, wildlife will disappear in the very near future. One way that wildlife can be conserved in shrinking pastoral areas is by improving the socioeconomic benefits accrued from wildlife to pastoral communities, and minimizing negative wildlife-related impacts such as livestock diseases and predation. Ashley and Elliott [18] showed that benefits from integrated wildlife and livestock production can be higher than those from either enterprise on its own. In order to maintain or, in most cases, restore a healthy ecosystem, economically attractive solutions must be developed and implemented.

One of the approaches of arresting the imminent problem of habitat, biodiversity and livelihoods loss in Africa has been the establishment of wildlife conservancies on communal lands. Community-based conservation (CBC) seeks to stretch conservation efforts beyond PAs, and bring communities into conservation initiatives through benefit sharing and participatory planning [19]. It presents an evolving set of economic, social, and institutional tools that seek to limit activities detrimental to wildlife, while providing economic benefits to communities. These benefits seek to balance the costs of living with wildlife [19, 20]. CBC model has strongly challenged the view of community areas as mere buffer zones of the state owned

protected areas. It has a potential for effective conservation and development contrary to the top-down approaches of protectionist conservation [21]. That calls for state and conservation agencies to reconsider how they engage the communal land owners in conservation policies.

A community wildlife conservancy is a constitution of one or several adjacent communal ranches. It represents an effort to leverage more communal land at the livestock-wildlife interface in Africa for conservation [1]. Over the last decade, an international conservation organization, African Wildlife Foundation (AWF) has developed and applied a landscape-scale conservation model, constituting land units under individual, communal and state protection [22]. African Wildlife Foundation has applied this model in eight priority conservation landscapes in 11 countries of Africa, areas referred as African Heartlands [22]. Intervention strategies AWF applies across the various Heartlands are protection of critical habitats and corridors by bringing land under 'conservancy' management, development of conservation-based enterprises, applied research and species conservation, development of capacity and leadership for conservation and, where necessary, engagement in policy and legislation work with partner governments [23]. The AWF's African Heartland program augments protected areas and helps to manage the surrounding areas, considering the needs of native species, ecosystem processes and local stakeholders [22, 23]. Such landscapes have the potential to provide economic benefits and ecosystem services that strengthen livelihoods of local people.

This review focuses on the establishment of community-based conservancies in northern Kenya, where the pastoral communities have adopted wildlife conservation as a land use, in addition to pastoralism. Naibung'a Community Conservancy in Laikipia County within the Ewaso ecosystem is used as a case study to highlight pillars of success and potential threats to conservancies in northern Kenya. Naibung'a conservancy straddles five administrative locations (Mumonyot, Ildigiri, Oloibosoit, Ilpolei and Ilmotiok).

2. Methods

This review was motivated by the paucity of published information on the growing trend of community wildlife conservancies' establishment in northern Kenya region. A lot of work has been done but most of the findings lie in consultancy reports and are not accessible to international audience. The study adopted a qualitative approach for data gathering and analyses. First, a literature review was conducted on the topic in context of the study area. Second, detailed field-notes from direct field observations were revised and similar information consolidated with the use of a summary table. All this information was harmonized during the write up, in order to glean out the impacts of conservancies on natural resources, pastoral livelihoods, security, their threats, and key pillars of the initiatives success.

2.1. Study area—the Ewaso ecosystem in northern Kenya

The Ewaso Nyiro Basin (**Figure 1**) is an area spanning over 30,000 km² with variable topography ranging from 200 to over 3000 m. Two major physical features influence the climatic and drainage

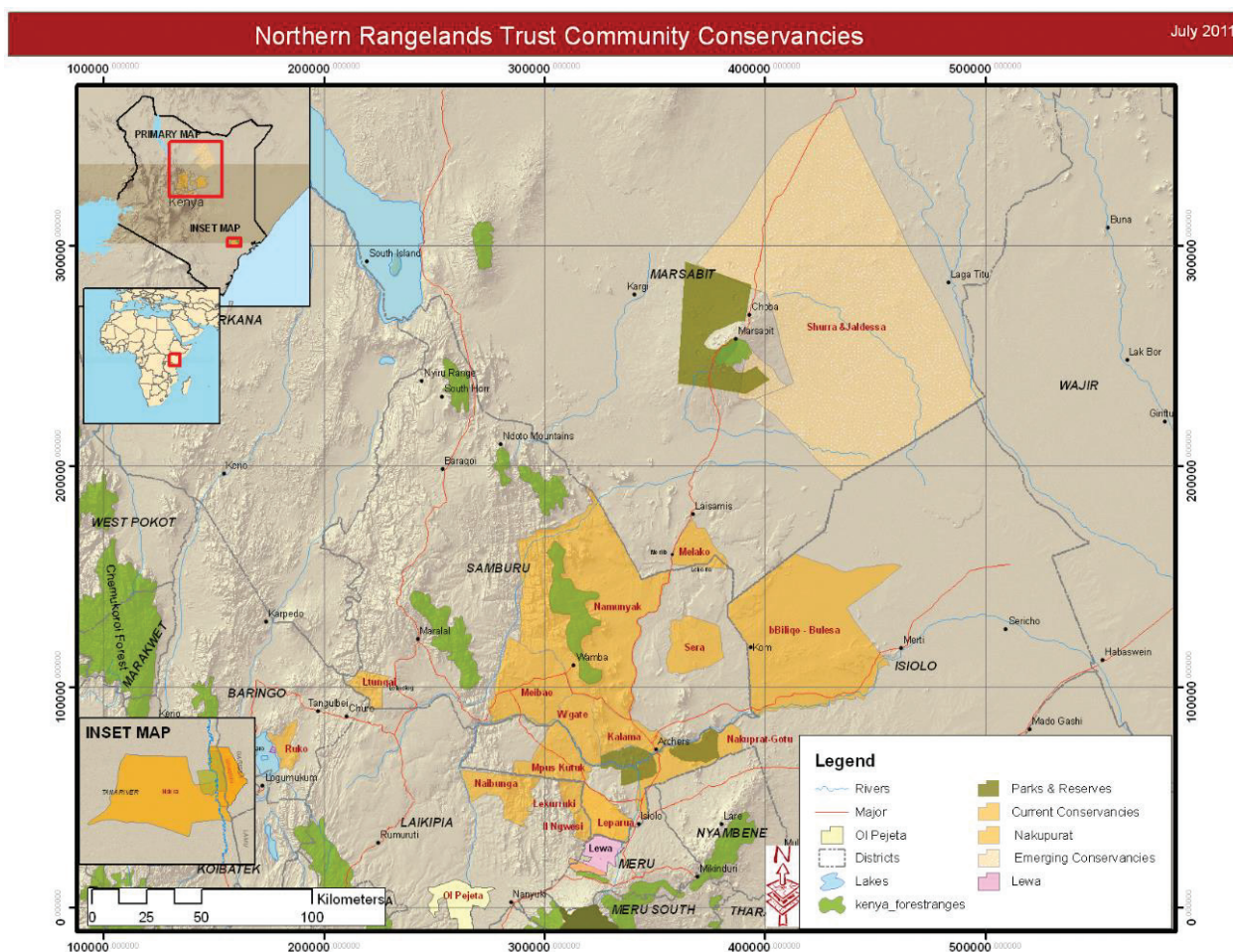


Figure 1. Spatial distribution of wildlife conservancies* in northern Kenya (courtesy of Dr. Juliet King, Northern Rangelands Trust).

patterns within this landscape: the Aberdare ranges system to the southwest that forms the source of Ewaso Nyiro River and Mt. Kenya to the east that provides many tributaries. The Mathews Range to the north is a source of a few ephemeral rivers [24]. The basin has a tropical wet and dry climate with warm and stable temperatures throughout the year, averaging to a daily maximum of 32°C. Seasonal changes in wind patterns result in distinct wet and dry seasons. There is a wide range in the total rainfall across the basin, from a minimum of 200 mm in the dry savannah to slightly over 650 mm per year near the mountain ranges. This climate, coupled with shallow and nutrient poor rocky soils render much of this area unsuitable for arable agriculture.

The basin is characterized by semi-arid vegetation systems apart from the Ewaso Nyiro river watershed draining from Mt. Kenya and the Aberdare ranges. These systems include savannah mosaic, acacia-grasslands, and *Acacia-Commiphora* scrubs [25]. These ecological conditions are mostly suited to livestock production, either in the form of commercial ranching or traditional pastoralism, which are the two main economic activities in the area. Species of livestock reared are mainly cattle, camel, donkeys, sheep and goats. The Ewaso Nyiro River remains the most important water source for human, livestock, and wildlife in the basin, up to Lorian swamp.

The basin is diverse in wildlife habitats, livestock, wildlife and culture. It is home to a growing population of elephants (*Loxodonta africana*) and the endangered African wild dogs (*Lycaon pictus*) [26]. It is also habitat to many endangered and semi-endemic mammalian species such as the Grevy's zebra (*Equus grevyi*). The specialist species in northern Kenya are the endangered Grevy's zebra, reticulated giraffe (*Giraffa camelopardalis reticulata*) and Somali ostrich (*Struthio camelus molybdophanes*) and Beisa Oryx (*Oryx beisa*), all of which are of distinct conservation interest. Other important large mammals are the endangered black rhino (*Diceros bicornis*), lion (*Panthera leo*), striped hyena (*Hyena hyena*) and spotted hyena (*Crocuta crocuta*), leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), Gemsbok oryx (*Oryx gazella*) and plains zebra (*Equus quagga*). The area has one of the highest concentrations of large mammal biomass in Kenya [26].

Although Kenya is renowned for its national parks and reserves, only three protected areas (PAs) are found in Ewaso Nyiro Basin (Buffalo Springs, Samburu and Shaba National Reserves). These areas account for 1.5% (455 km²) of this vast and biodiversity rich landscape [24]. Private (e.g. Lewa) and community-based (e.g. Il Ngwesi, Kalama, Lekurruki, Naibung'a, Namunyak, Kalama, Sera and West Gate) conservation initiatives (**Figure 1**) are gaining credence as the sustainable solution for both wildlife and local communities. These would add over 200,000 ha (> 2000 km²), about 7.5% of land to conservation activities. Consequently, they effectively increase area under wildlife-based enterprises by a factor of five. In all the pastoral rangelands of northern Kenya, there are no fences. It is one of the few places left in Africa that allow for the free movement of wildlife and livestock across a vast area that is protected by communities [1, 2]. Tolerance for wildlife is generally high even among the locals, and is increasing mainly because of increase in tourism-based enterprises in the region's communal ranches. Since cultivation is not a feasible option in northern Kenya, the system of land use adopted by communities in the conservancies and associated communal ranches must derive from livestock keeping and wildlife conservation.

3. Community-based conservation initiatives in Ewaso Nyiro basin

In Kenya, CBC initiatives have their origin from the United States Agency for International Development (USAID) funded Conservation of Resources through Enterprise (CORE) project in early 1990s. Its goal was to improve benefits to communities and landowners in areas critical to parks and reserves and in that way achieve better conservation and management of natural resources. It involved development of community conservancies with tourism infrastructure, for example eco-lodges, tented camps and cultural manyattas [27]. Il Ngwesi, Lekurruki and Namunyak were the first such conservancies to be set in northern Kenya, between 1996 and 1999 (**Figure 1**). More than 15 other conservancies (e.g. Kalama, Naibung'a, Sera, Ishaqbini) have been established after apparent successes of the pilot and increased cohesiveness among the communities. These conservancies have changed substantially the land use face of this region (**Figure 1**) [1]. Such CBCs have in various programmes and projects established collaborations and strong working partnerships with various governmental and non-governmental institutions. These partnerships have enabled the stakeholders to combine their resources to

ensure the development and success of the CBCs. Some of the key partners include African Conservation Center, Arid Land Resource Management Programme, AWF, Government of Kenya (through various Ministries), Kenya Wildlife Service, Lewa Wildlife Conservancy, Laikipia Wildlife Forum, Ol Pejeta Conservancy and Northern Rangelands Trust (NRT), among others. This collaboration and partnership is an incentive towards improved natural resources management. As wildlife is more and more accepted as a land use, community participation is critical in wildlife management and pastoral livestock production enterprises in efforts to enhance positive economic and ecological change.

3.1. The Naibung'a wildlife conservancy

Naibung'a Conservation Trust was established in 2001 by Laikipia Wildlife Forum through the collective effort of nine Maasai communal ranches in the western part of the Mukogodo Division in Laikipia County (**Figure 2**). These nine communal ranches are part of the large Mukogodo pastoral system that includes Tiamamat, Kijabe, Koiya, Ilmotiok, Musul, Nkiloriti, Morupusi, Ipolet and Munishoi (**Table 1**). The ranches are communally owned within the provisions of the community-representative, land tenure system found in CAP 287 of the Laws of Kenya. The communities of neighboring ranches (**Table 2**) came together and combined

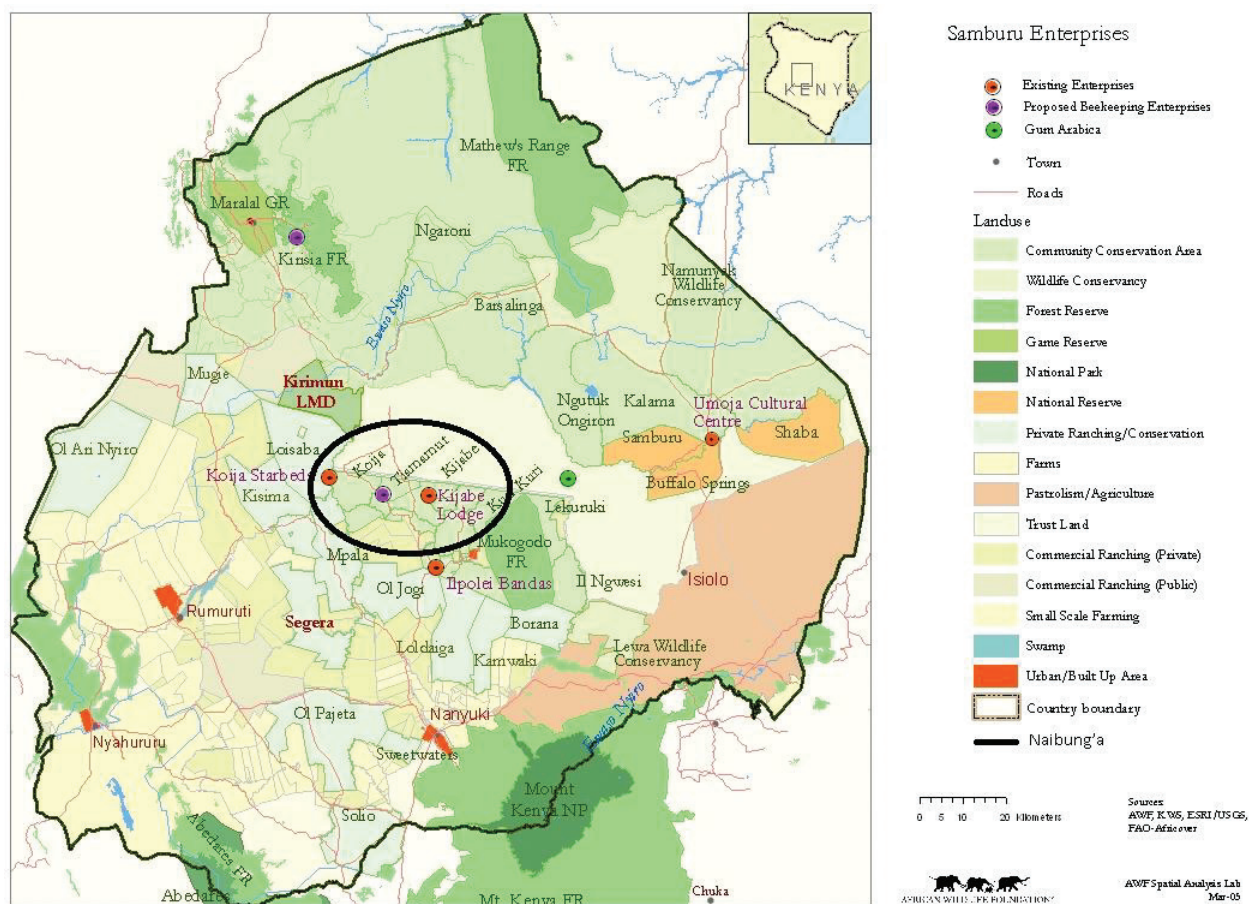


Figure 2. African wildlife Foundation's Samburu heartland showing location of Naibung'a community conservancy, circled. Courtesy of African wildlife foundation (AWF).

Location	Mukogodo Division, Laikipia District in Ewaso Nyiro Basin
Constituents community ranches	Koiya, Il Motiok, Tiamamut, Kijabe, Nkiloriti, Musul, Il Polei, Munishoi and Morupusi
Ethnicity	Mukogodo Maasai
Population	14,256 people (2009 Census)
Land ownership	Community ranches with and without title
Core conservation area	75,947 ha
Main livelihood	Pastoralism (Livestock-keeping)
Key wildlife species	Elephant, Zebras (Plains and Grevy's), lion, leopard, giraffe, African Wild dog, Gerenuk, Impala, Gazelles (Thomson's and Grant's)
Year of registration	2001
Staff employed from the community	21
Annual operating budget	US\$ 44,500

Table 1. Facts about Naibung'a wildlife conservancy in northern Laikipia (source: NRT [1]).

their lands and resources into one large community conservancy. However, constituent community ranches still have some level of autonomy. Community members accepted the need for conservation efforts in the area in order to address the challenges of increasing human and livestock population and high environmental degradation. The high diversity of wildlife in the area also presented an opportunity for the community to tap from the booming tourism industry in Kenya. However, they could only do so if they got organized. The conservancy,

Location	Sub-location	Community Ranch(es)	Area (km ²)	2009 population size					
				Male	Female	Total	House holds	Density	Persons/HH
Mumonyot	Mumonyot	Morupusi	75.9	958	987	1945	350	25.6	5.6
Ildigiri	Tura	Musul II, Kijabe, Ilkiloriti	118.1	1562	1429	2991	478	25.3	6.3
Oloibosoit	Ewaso	Koiya	81.3	1366	1321	2687	549	33.1	4.9
Ilpolei	Ilpolei	Ilpolei, Munishoi, Musul I	383.8	1820	1647	3467	793	9.0	4.4
Ilmotiok	Ilmotiok	Ilmotiok, Tiamamut	100.3	1558	1608	3166	473	31.6	6.7

The sex ratio for of the area is 1:1 for male to female (Source: [28]).

Table 2. Population distribution among community ranches constituting the Naibung'a wildlife conservancy and for various administrative areas within Mukogodo division.

therefore, works as a catalyst for wildlife conservation, environmental rehabilitation, resource conflict resolution and sustainable enterprise development for members of the nine communal ranches. Its mission is to conserve the integrity of the natural and cultural resources of the Laikipia Maasai area, while promoting the sustainable use of these resources in eco-tourism development to provide economic benefits to conservancy members.

Although most of the wildlife populations in Laikipia County are concentrated in private ranches, a substantial number is found in Naibung'a [29]. Wildlife dispersal into community ranches is more common in the wet season –when grazing and foraging is not a limitation. The conservancy is home to populations of elephant, zebras (plains and Grevy's), gerenuk, warthogs, dik-diks, impalas, gazelles, hippos, buffaloes, African wild dog, hyenas and lions. Other small animals include Granos, Clip, rabbit and tortoise among other wildlife species [30].

Naibung'a conservancy straddles five administrative locations (Mumonyot, Ildigiri, Oloibosoit, Ilpolei and Ilmotiok) in Laikipia Sub-county. The 2009 National Census shows it has a population of 14,256 over an area of 759.47 km², a density of 24.92 persons km⁻² [28] (**Table 1**). This density of settlement is categorized as low, and is not dissimilar to population distribution in other dryland areas in the country [31]. However, the high population growth rate has caused a lot of pressure on the available infrastructure and natural resources, especially grazing and water resources, at times degenerated into community conflicts.

Mukogodo Division in which Naibung'a is found is mainly inhabited by the Laikipia Maasai community, who practice and depend on pastoralism for their livelihoods [32]. As the area is semi-arid, livestock keeping is the most viable economic practice. Mukogodo is considered as the poorest division in Laikipia County, as pastoralism which is most prevalence yields generally low income levels. The high levels of poverty among the Mukogodo pastoralists has been attributed to; the loss of livestock due to drought, diseases, extensive land degradation, poor management of the community ranches, high illiteracy levels, lack of employment opportunities, banditry and cattle rustling and the general inability to exploit the available natural resources such as sand and wildlife that can be a source of supplementary income for the community's benefit [32]. Drought and insecurity are the most critical challenges facing the Mukogodo pastoralists. Long-term investment and sustainable drought management and mitigation programme need to be developed.

3.2. Conservation planning within Naibung'a wildlife conservancy

One of the objectives of the wildlife conservancies is to promote the ecosystem recovery and sustainable use of natural resources. This is viewed as an important pillar for the success of conservation efforts both at the conservancy and constituents ranches level. As part of a landscape level conservation planning, the natural resource management (NRM) plans for the Naibung'a Wildlife Conservancy were developed in 1999 by African Wildlife Foundation (AWF) and The Northern Rangelands Trust (NRT) together with a number of other conservation supporters and the communities [22]. This involved a landscape-scale systematic conservation planning including developing strategies to help the local communities to benefit from nature tourism and resources on their land [29], and to prevent further habitat loss in community ranches. The NRM planning encompassed participatory land zoning designating

zones for core conservation, livestock grazing and settlement according to ecological capacity and the most beneficial economic activity of a particular area [33]. Zoning is undertaken during sustainable resource use planning, and is key to successful management of livestock-wildlife interface areas, and reflects a commitment by the communities to conservation. Community members participate in a joint PRA exercise to demarcate zones for conservation, multiple uses and settlement. The zoning provided a means for actualizing a systematic, landscape-scale conservation planning and budgeting for the utilization of natural resources [34]. The NRM planning also targeted strengthening of local governance institutions by setting up two new thematic management committees, Conservation committee and Grazing and Settlement committee under the legally recognized Group Ranch Committee. In each zone, specific management strategies are employed by the conservancy aiming to sustain wildlife population numbers within the wider context of NRM Plans as follows:

- a. *Core conservation (preservation) zone* - low intensity use zone, areas with good wildlife habitats, water, and are usually the best places to find wildlife. Core conservation zone where livestock and human traffic is removed through a process of monitoring by community scouts. The monitoring is required to reduce incidences of poaching and illegal grazing that allow the rangeland vegetation to recover and to track wildlife trends by recording citing and signs (dung, footmarks or audio signals). Use of community scouts also provides employment opportunities to some of the youths contributing to the economic benefits of the conservancy. The scouts are also being trained to promote strategies geared towards reducing human-wildlife conflicts. For example, warning herders of predator species like the presence wild dogs and hyenas reduces livestock depredation. These strategies have increased the numbers of resident wildlife in Koiya, Tiamamut, Kijabe and Nkiroliti community ranches over the past few years.
- b. *Buffer grazing zone (low intensity, multiple use zone for grazing and conservation)* - is the transition zone between the core conservation zone and the high use or settlement zone. The grazing zone is also a wildlife dispersal area and is further demarcated into wet and dry season grazing areas that allow for rotational grazing management aimed at optimizing the use of grazing resources within the community ranches. A study by Mureithi et al. [35] reported that increased grazing pressure in the grazing zones has led to reduced herbaceous cover, species diversity and biomass production. He emphasized on the role of regulated grazing in maintaining productivity of semi-arid rangelands.
- c. *High intensity use zone (for all other activities including settlements)* - Settlement zone where the communities put up their *Manyattas* and *bomas* (homesteads and cattle corrals, respectively), and other people oriented ranch infrastructure such as health clinic, nursery school for children and the community ranch office. The proximity of such installations to each other increase security for the people and make relief accessible.

Currently only four of the nine community ranches in Naibung'a conservancy have established land use zones with clearly mapped geo-referenced boundaries. These are Koiya, Tiamamut, Kijabe and Nkiroliti community ranches (**Figure 3**). The boundaries have been documented by NRT and AWF which have been working closely with the four community ranches within the Naibung'a Wildlife Conservancy.

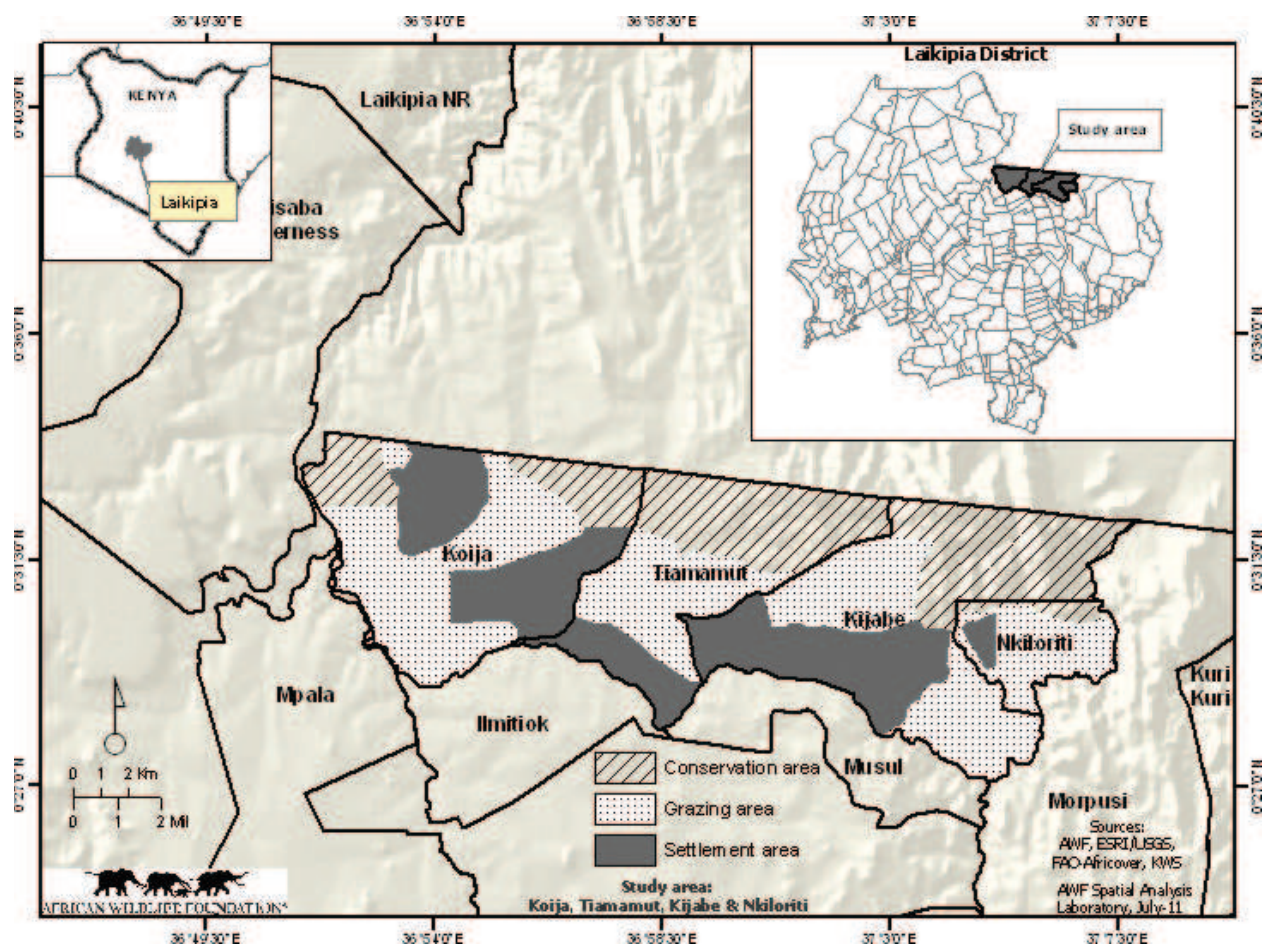


Figure 3. Land use zone for Koiya, Tiamamut Kijabe and Nkiloriti community ranches. Courtesy of African wildlife foundation (AWF).

4. Discussions

4.1. Impacts of conservancies on natural resources

Panoramic satellite imageries show most community areas in northern Kenya in very poor range condition [36]. Presently the pastoralists have to move their livestock out of the community ranches in normal dry seasons in search of pasture, unlike in the past when such migrations only occurred during protracted droughts. Environmental degradation has resulted into loss of wildlife habitats, biodiversity, communities' grazing land and water resources and thus eroding pastoral livelihoods base. Poverty and insecurity is on the increase as the natural resource base, and especially pasture and water resources are degraded. In the biodiversity-rich Ewaso Nyiro Basin, conservation strategies aimed towards environmental rehabilitation and improved grazing management are critically needed. A review of effectiveness of the NRM planning on ecosystem health was carried out in 1999 for Koiya, Tiamamut and Kijabe community ranches in Naibung'a Wildlife Conservancy. An analysis of normalized difference vegetation index (NDVI) between years 2000 and 2004 by Oguge [24] showed a significant increase in NDVI in the core conservation zones of Kijabe and Koiya community ranches. This indicated an increase in vegetation

biomass suggesting an improvement in ecosystem health. Only modest increase in NDVI was noted in the conservation zone of Tiamamut community ranch. Conversely, the settlement and grazing zones showed significant decrease to no change across most of the landscape. Exceptions were small grazing areas bordering conservation areas in Kijabe and Koiya, respectively [24].

Desirable vegetation change is the best indicator of improved range condition in semi-arid ecosystems. The significant increase in plant cover over a 5-year period (1999 - 2004) suggests modest success in the role of NRM planning in reversing the trends in ecosystem degradation. Satellite imagery analyses by Oguge [24] were corroborated by vegetation data from ground truthing. Results of vegetation data showed high species richness and diversity in the conservation area of Kijabe community ranch indicating that the NRM planning had to a reasonable extent had led to the slowing of ecosystem degradation. Ten years after the NRM planning began in Kijabe conservation zone, herbaceous vegetation (mainly grasses) has fully recovered, to the extent that the management is weighing options to open up the area for guided high intensity grazing of livestock. The Kijabe conservation zone is hilly and rugged and is not preferred by zebra for grazing as the plains. Zebra is an avid grazer that opens up grass, enhancing further regeneration (AWF, Zebra fact file). Small game such as the Grant's and Thomson's Gazelles are observed to have moved out of the conservation zone due to the tall vegetation, a behavioral change to avoid predation. They are now commonly found on the open plains of the Kijabe grazing zones. Other options like mowing and burning are least desirable in the conservation area setting. If left unattended, the range condition would decline due to the growth of shrubs and bush replacing the grasses in absence of grazers. *Themeda triandra*, an important forage species that had locally disappeared is presently abundant in Kijabe conservation area indicating the NRM planning effectiveness in restoring the biodiversity.

4.2. Impacts on the pastoral socio-economic status

The long-term conservation of wildlife in Kenya's northern rangelands is inextricably linked to the fate of the local pastoral communities. These communities are politically and economically marginalized, and opportunities for economic growth have been hindered by insecurity and by longstanding ethnic rivalries and resource use conflicts in the region. The increasing trend in the uptake of community-based conservation in northern Kenya shows acceptability of the initiative by the communities. More new conservancies are in the process of being established in Samburu and Isiolo Districts. Olesarioyo [30] showed that the communities in Ewaso Nyiro Basin benefit, both directly and indirectly, by having wildlife on their land. However, trade-offs cannot be avoided between the existing community best management practices that promote the use of pastureland for livestock production, in co-existence with high numbers and diversity of wildlife. Benefits associated with the initiative include; secure resource rights and strong local institutions, eco-tourism enterprises revenue sharing and incentives, strengthening resource access and tenure rights, conservation-friendly cultural and spiritual values and improved human security [30]. Costs include competition for pasture and water, and livestock losses from predation and diseases.

Other indirect benefits derived from conservation management include linkages to livestock marketing opportunities. For instance, in 2009, the NRT and AWF together with Ol Pejeta Conservancy (OPC) initiated a community livestock outreach component 'linking livestock markets to wildlife conservation'. The initiative purchased a total of 580 heads of

cattle from seven community ranches paying KES 16,770.96 per head, 30% higher than the market price [37]. The aim was to reduce the stock density on the community ranches while increasing income to the households. Reduced stocking density hastens rangeland vegetation recovery [38].

Wildlife conservancies also present a better opportunity of institutionalizing the communal land ownership in northern Kenya. Owning land as a community is vital for provision of key resources such as grazing and wooded lands in arid and semi-arid areas [39]. Significantly, such ownership arrangement protects the land from sub-division and secures it for the future generations of the pastoral communities [40]. The conservancies present avenue for planning, implementing and re-orienting natural resource management and conservation efforts in a way that all the four segments in the conservation complex (people, land, wildlife and livestock) are at a balance. The ecotourism infrastructure in the conservancies is also expected to improve the general regional development.

4.3. Impacts on insecurity on wildlife, livestock and people

Historically, northern Kenya region is volatile, characterized by frequent incidents of insecurity, aggravated by its proximity to Somalia and Ethiopia. In the last decade, efforts by the Kenyan Government and local communities have significantly reduced the human insecurity problems. However, wildlife has not been so fortunate. In some areas poachers present a serious threat over the remaining wildlife populations [1]. Establishment of security systems is integral to the overall protection of wildlife in the region. Once a community wildlife conservancy is formed, it institutes its security operations as a matter of priority. The operations aim at improving stability to residents, wildlife, and visitors to the area. Without security, other activities related to conservation and community development cannot effectively operate. NRT has an integrated security network which operates across the region with robust radio communications, professionally trained security staff and Conservancy Security Scouts. Conservancy security teams are networked and closely linked to the Kenya Wildlife Service and Kenya Police. Additional support in the form of aerial back-up, tracker dogs and armed security is available from the Lewa Wildlife Conservancy as required. Effective communication and rapid response initiatives have significantly improved the security of the region.

4.4. Threats facing natural resources and livestock management

The community wildlife conservancies in northern Kenya are threatened by numerous factors. These factors are briefly discussed below:

4.4.1. Climate variability and change

Declining annual rainfall and prolonged droughts affects plant regeneration posing a serious threat to pasture availability and range rehabilitation initiatives in arid and semi-arid rangelands. The higher frequency of prolonged droughts in northern Kenya is encouraging the influx of immigrant pastoral communities within the region. The increased pressure on the limited vegetation resources from the immigrants encourages resource use conflicts. Communities are forced into negotiated grazing arrangement with the private ranchers at a fee. Those who

cannot afford the fees to trek with their animals to Mt. Kenya forest blocks. Implication of such movement is that large herds of animals are lost because of cold climate and associated diseases around the Mountain. Climate variability and change may also increase the prevalence of vector-borne and zoonotic diseases.

4.4.2. Invasive species

Acacia mellifera, *A. reficiens*, *Opuntia spp.*, *Datura sp.*, *Propopsis juliflora*, *Sansevieria intamida* are the most widespread invasive species in the conservancies undermining the quality and quantity of forage species. These invasive species suppress the growth of pasture grasses for livestock and wildlife. *Datura sp.* and *Prosopis juliflora* if ingested have poisoning effect on animals [30]. Control of weeds is imperative to the restoration and maintaining of healthy and productive pasturelands. Attempt to mechanically control *Sansevieria intamida* from rehabilitated sites in Tiamamut Community Ranch by uprooting, heaping to dry or dumping in deep gullies have been going on with some success. *Acacia mellifera* and *A. reficiens* is being controlled through de-branching and using the cut branches to erect fences around enclosures [41].

4.4.3. Unsustainable and competing land uses

Practices such as overstocking (in absence of livestock marketing links and/or presence of quarantines), dry land agriculture, deforestation, unmanaged sand and stone harvesting, charcoal production and unplanned human settlement have negative impact on conservancies. These practices threaten the sustainability of the community wildlife conservation efforts prompting the need of good land use plans to accommodate different uses. Enforcing of the community enacted by-laws to govern the land use zones is being applied in Naibung'a to tackle this problem.

4.4.4. Cattle rustling

This problem is propagated by factors such as, drought, diseases and ethnic cultures leading to losses of livestock and human lives: This problem is particularly common in dryland areas of East Africa where pastoralism is practiced [1, 2, 42]. It is deemed as a cultural adaptive strategy to restock after losses due droughts and diseases. The result is ethnic clashes and rivalry that hamper conservation and development.

4.4.5. Predation of livestock

The most common predators in the conservancies are lions, leopard, cheetah, hyenas and the African wild dog. According to NRT [1], STE [2] and Frank [43], each year, carnivores kill approximately 0.8% of cattle and 2.1% of sheep on private commercial ranches, and 0.7% of cattle and 1.4% of sheep and goats on pastoral community ranches in Laikipia County. The slightly lower loss rates of predation in pastoral community ranches are probably a reflection of the higher numbers of livestock and lower numbers of predators on these lands. The impact of predation is fairly small in comparison with that of diseases and drought. Nevertheless, losses to predation are serious, and may have an important impact on the livelihoods of pastoralists, and on incomes of commercial ranches [1, 2, 43].

4.4.6. *Human-wildlife conflicts*

The human-wildlife conflicts take various forms, including - carnivores attacking and killing livestock, herbivores raiding crop, attacks on humans, competition for pasture and water and transmission of zoonotic diseases [44–46]. In northern Kenya, competition for pasture and water is the most serious form of human-wildlife conflicts [30]. Authorities of Samburu, Buffalo Springs and Shaba National Reserves have to deal with constant pushing of livestock outside parks and reserves. Competition for limited pasture and water intensifies during the dry season. The main wild competitors for pasture are the elephants and zebras. Wildlife uses various tactics to compete for the resources to the advantage of livestock. For example, elephants and baboons become violent in the face of water scarcity resulting in destruction of property and life. Grevy zebras contaminate the watering point with their urine, which livestock cannot drink. In most cases, elephants destroy watering point, thus lowering water quality for domestic and livestock uses [30].

4.5. Roadmap for conservancies success

4.5.1. *Clear and effective land zonation*

There are various weaknesses related to land zonation that has been done in most conservancies and their constituent ranches. Limitations of the zones are not well understood, hence there is abuse of the zoning system. There is no clear demarcation of the core conservation area. The objectives of the zoning should be clearly defined and the communities should be actively involved in the zoning exercise. For the conservancies to succeed, the boundaries of the zones should be clearly established in a participatory manner and geo-referenced for monitoring, followed by by-laws and drawing up of specific management strategies applicable for each zone. An inventory of resources and other decision making tools for the zones need to be applied.

4.5.2. *Water resources management*

Water is a resource causing frequent conflicts because of high demand exacerbated by drought, destruction of catchment and pollution. It is one of the critically threatened resources in the conservancy and therefore requires proper management. Strategies for rain-water harvesting and storage are needed. For example, a rock infrastructure for rain water harvesting has been established at Nkiloriti community ranch with support from AWF and is now functional. In the low lying areas desilting water pans and shallow dams can help in harvesting flood water during storms.

4.5.3. *Livestock management and marketing*

The economy of pastoral communities in northern Kenya is primarily livestock-based. Being an integral component of land use, livestock production should be a key component in the conservancies' NRM plans and in any other development initiative in the region. Improved livestock management can be enhanced by strengthening the grazing committees through awareness and leadership training, logistical and other support systems for livestock marketing, use participatory grazing by-laws; education to local communities on benefits of correct stocking and

shunning from negative cultural practices such as cattle rustling. Rangeland improvement through reseeding degraded patches in the grazing zones can improve the grazing resources. Key grass species that are reported as suitable for the rehabilitation of grazing lands in the region include *Cenchrus ciliaris*, *Eragrostis superba* and *Enteropogon macrostachyus* [47].

4.5.4. Development of human support infrastructure

Support infrastructure for transport, communication security system, information, health, education, governance and other basic support services are key for the implementation of NRM plans. The conservancies need to mobilize more resources to rehabilitate existing pastures and to develop necessary support infrastructure for the implementation of NRM plans.

5. Conclusions and recommendations

Community-based conservation is a new conservation approach unfolding across Africa, based on a premise to maintain and improve wildlife habitats on areas outside the parks and reserves. The approach as applied in wildlife conservancies in northern Kenya attempts to engage the local people in conservation initiatives through participatory planning of their land and natural resources and benefit sharing. The case of Naibung'a Wildlife Conservancy presented in this review demonstrate that community conservancies are a viable avenue for conserving the biodiversity and habitats while promoting human development through improvement of pastoral livelihoods. The approach could uphold the way of life for pastoral communities and their economy, and prevent threats from land sub-division that dismantles pastoralism. Ecological and socio-economic benefits are projected following the leveraging of expansive areas under conservancies, improving their management, and addressing people's attitude to foster wildlife conservation. This notwithstanding, addressing threats facing the conservancies and the costs of sharing resources with a diverse wildlife species is core to sustainability of the initiatives.

Recommendations made here for effective mitigation of threats and conflicts facing natural resources, and to ensure success and sustainability of Naibung'a and other community wildlife conservancies in northern Kenya are: (a) continued capacity building among members of the conservancy on sustainable use and management of their natural resources, (b) improvement of land zoning systems that will enable better and expand the wildlife management programmes in the conservancy, (c) develop better and improve existing security and rapid response systems, (d) devoting more efforts to reduce the costs and risks, while contributing to the communities' benefits for keeping wildlife on their land, and (e) building stronger and more equitable governance institutions at community levels, that secure property rights of the pastoralists communities, promote active community participation and promote equitable benefit sharing, partnerships and distributed development. Communities must not only benefit but must be part of, if not drivers of the change. Conservation will thereby need to be people centered and address the real and diverse livelihoods needs of communities, and provide sufficient benefits and incentives for the people to sustain the initiatives in the long term.

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