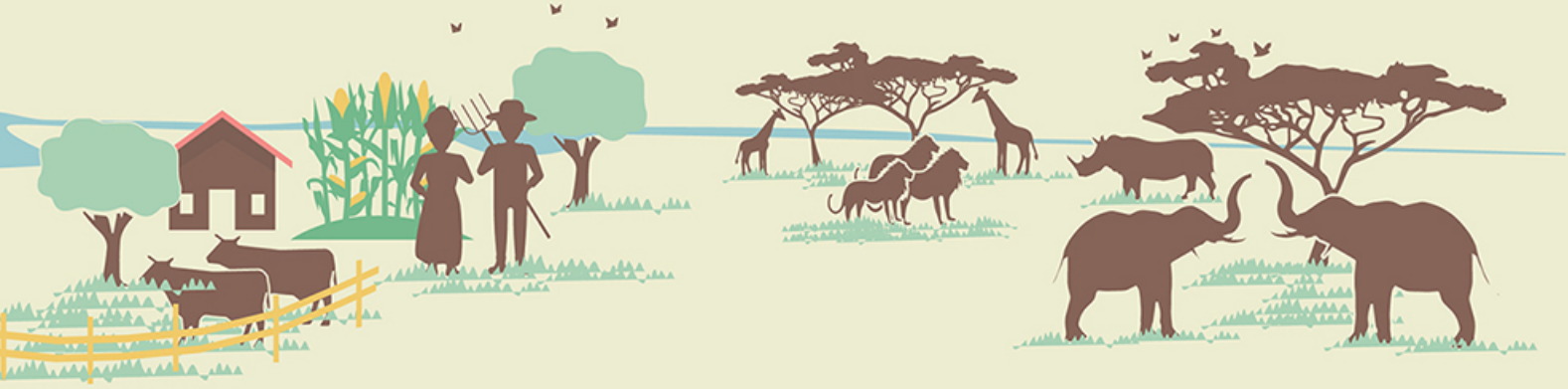

STATUS AND VIABILITY OF WILDLIFE CORRIDORS IN THE MAASAI MARA ECOSYSTEM

Initiative for Conservation of Mara - Serengeti Transboundary Ecosystem (SEMA Project)

This project is funded by the European Union

KENYA WILDLIFE SERVICE

Vi Agroforestry

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Disclaimer:

The views and opinions expressed in this report reflect those of the authors based on the results of the just concluded corridor mapping and do not necessarily reflect those of the Kenya Wildlife Service (KWS), Vi Agroforestry or the European Union. Whilst every care has been taken in the carrying out the corridor mapping in the Mara and preparation of the report, the authors accept no responsibility for any resultant errors contained herein, any damages or loss whatsoever caused or suffered by any individual or organization.

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Concept : Stephen Mwiu
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STATUS AND VIABILITY OF WILDLIFE CORRIDORS IN THE MAASAI MARA ECOSYSTEM

Initiative for Conservation of Mara-Serengeti Transboundary Ecosystem (SEMA Project)

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Executive summary

Actions under SEMA Project contributes to the conservation of the Mara-Serengeti Transboundary ecosystem through empowering local communities to adopt sustainable livelihoods and enhancing regional cooperation. The action supports cross-regional wildlife conservation and natural resources management by enhancing intra and inter country dialogues and participatory decision making among government and other stakeholders on policy, legal and regulatory frameworks. The Mara Serengeti transboundary ecosystem is renowned for its spectacular wildlife and scenery. It comprises multiple resource use areas and different categories of protected areas, communal and private lands extending from South-Western Kenya and into Northern Tanzania. The ecosystem is governed by Narok County in Kenya and Tanzania National Park Authority (TANAPA) in Tanzania. Although the Trans Frontier Conservation Area (TFCA) is an integral natural asset to both countries, pressing natural resource management and biodiversity conservation challenges are threatening the ecosystem. SEMA project through technical support from Kenya Wildlife Service and Tanzania Wildlife Research Institute undertook mapping of wildlife corridors in Maasai Mara and Serengeti ecosystems respectively and came up with reports on the status and viability of wildlife corridors in their respective ecosystems.

Maasai Mara Ecosystem is a key biodiversity hotspot, which supports large numbers of flora and fauna. This ecosystem is facing a lot of pressure from human population increase thereby reducing space for wildlife through land use changes. Wildlife corridors are important physical connections and linkages between isolated habitats, as is now the case in the ecosystem. The corridors promote the survival of species in environments hence maintaining landscape patterns and ecological processes. Vision 2030 identifies securing of wildlife dispersal areas and migratory corridors and pathways as significant ingredients of sustainable eco-tourism. Wildlife disperse or migrate across landscapes to access vital resources such as pasture, water, and breeding grounds; to reduce the risks of predation; and to enhance genetic health. Wildlife migratory corridors connect core habitats and are critical for species' survival and long-term viability of ecosystems. It is therefore the duty of KWS and its stakeholders to ensure that wildlife habitat and corridors are protected for posterity. The main objective of the study was to best understand current general wildlife movement patterns and compare with previous movements, further leading to the assessment of the factors contributing to the drastic change in the movement from the previous to the current status along the Narok-Sekenani road in Maasai Mara ecosystem. A total of nine corridors were identified which were subjected to a prioritization matrix and corridors #1, #6 and #3 (Figure 6) were prioritized as important corridors and that require quick interventions in order to secure them. The corridors were prioritized based on attributes which may have positively or negatively influenced viability as a corridor. Positive attributes included presence of elephant dung, proportion of wild animals sighted within 200 meters and water availability. Those attributes which negatively impacted on the corridor included presence of livestock, permanent *mabati* roofed or concrete houses, grass thatched or cow dung huts (Maasai Bomas), threats such as charcoal and logging, presence of alien invasive plant species and presence of fences (electric, plain and barbed wire).

Securing these corridors can be accomplished through:

1. Establishment of conservancies especially the area north west of Olkinyei, east of Olarro and Siana conservancies and areas around Naikara and Olderkesi,
2. Through leasing of land especially on corridor #3 which connects Olkinyei and Olarro conservancies, and;
3. By a spirited campaign to mitigate against the negative impacts of development activities such as fences and moats across wildlife dispersal area. Stakeholder engagement and conflict resolution will help in ensuring that corridors are safeguarded as key habitat links.

Acknowledgment

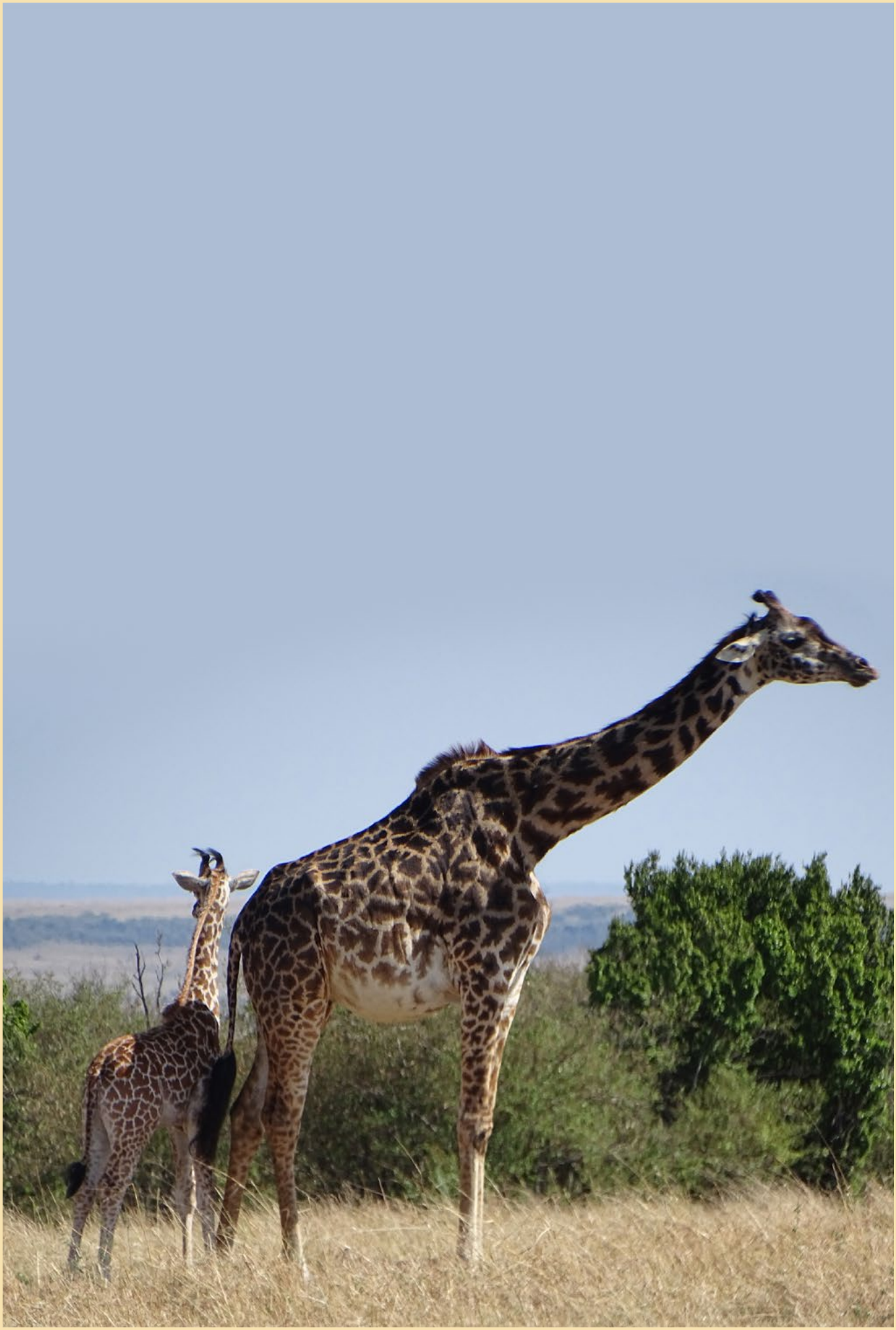
The corridor mapping in the Mara ecosystem has been a consultative process. This was an assignment in contribution to Vi Agroforestry's Serengeti – Mara Ecosystem (SEMA) Project under the funding of The European Union. It has been successful through the partnership of Vi Agroforestry and Kenya Wildlife Service, Narok Station.

The authors of this report wish to acknowledge with deep appreciation the various partners who immensely contributed to and facilitated the mapping and production of this piece of work. In particular, the team wishes to thank the Director General, Kenya Wildlife Service (KWS) for the approval to conduct the activity. We further thank Mr. Akoto of Vi-agroforestry and the KWS Senior Warden - Narok County for coordinating the planning and the implementation of the survey.

We would also like to thank the various conservation and private partners who provided data on wildlife movement and most specifically the Mara Elephant Project, Kenya wildlife Trust and African Bioservices project.

List of Acronyms

CR	Critically Endangered
EN	Endangered
FOC	Friends of Conservation
GIS	Geographical Information System
IBA	Important Bird Area
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
Km	Kilometers
KWCA	Kenya Wildlife Conservancies Association
KWS	Kenya Wildlife Service
KWT	Kenya Wildlife Trust
Lvemp	Lake Victoria environmental management programme
MEP	Mara Elephant Project
MMNR	Maasai Mara National Reserve
MMWCA	Masai Mara Wildlife Conservancies Association
MT	Mara Triangle
MTP	Medium Term Plan
NGO	Non-Governmental Organization
NT	Near Threatened
PA	Protected Area
TFCA	Trans-Frontier Conservation Area
VU	Vulnerable
WRA	Water Resources Authority
WWF	World Wildlife Fund for Nature - Kenya



1. INTRODUCTION AND BACKGROUND

Vi Agroforestry

Vi Agroforestry is a Swedish non-political, non-religious and non-profit organisation registered in Sweden as a Foundation and in Kenya, Uganda, Tanzania and Rwanda as a Non-Governmental Organization. Its headquarter is situated in Stockholm, Sweden, with a Regional Office in Nairobi, Kenya and with the Kenya Country Office located in Kitale. Its vision is "a sustainable environment that enables women and men living in poverty to improve their lives". This is by fighting poverty and climate change through agroforestry and strengthening of farmers' organizations, empowering of smallholder farmer families to reduce poverty, hunger while also addressing deforestation and land degradation thus contribute to increased biodiversity. Its target group is smallholder farmer families living in poverty in areas vulnerable to climate change in Sub-Saharan Africa with a special focus on women, youth and children who are members or potential members of democratic farmers' organizations. Since 1983, Vi Agroforestry has been supporting landscape restorations and agroforestry practices in East Africa. Vi Agroforestry is implementing SEMA project with support from the European Union together with FINTEA Growers Union and BUFADESO both member-based organizations with operations in Kenya and Tanzania respectively. In Kenya, the project is working with Water Resources Authority (WRA), Friends of Conservation (FOC) and Kenya Wildlife Service (KWS) as associates.

The Kenya Wildlife Service is a Kenya state corporation that was established in 1989 to conserve and manage Kenya's wildlife. It is established under an Act of Parliament Cap 376 with the mandate to conserve and manage wildlife in Kenya and to enforce related laws and regulations. The roles undertaken by KWS in the SEMA Project included actions focusing on promotion of wildlife and wildlife habitats protection and conservation through cross sectoral and cross border dialogues as well as enhancing community involvement in enforcement of wildlife management laws. Identification, rehabilitation, protection & conservation of wildlife corridors is a key action that conducted by KWS and implementation of the recommendations resulting from the study will be key towards conserving wildlife corridors and dispersal areas in the Maasai Mara Ecosystem.

SEMA project contributes to enhancing regional cooperation and partnerships among stakeholders of the Mara-Serengeti TFCA for improved sustainable management of the TFCA. The Action supports conservation of Serengeti-Mara transboundary ecosystems through empowering local communities to adopt sustainable livelihoods and enhancing regional cooperation in Kenya and Tanzania.

Maasai Mara Biodiversity

The Mara ecosystem plains are famously known as a biodiversity hotspot. There has been documentation of the Mara having the highest density and most diverse combination of large herbivores such as the wildebeests, which are known for their seasonal migration between the Mara and Serengeti plains and between Mara conservancies and Loita plains (Ogutu *et al.,* 2005). Other migratory wild animals found in the Mara ecosystem include the grant's gazelles *(Gazzella grantii)*, zebra *(Equus burchellii)* and eland *(Tragelaphus oryx)*. These animals migrate from the Serengeti National Park and occupy the National Reserve, the adjacent community owned conservancies and the dispersal areas (Figure 1). Some herds of all the four migratory species are also resident in the Mara. Human encroachment and land use changes especially in the Loita plains has, in the past 5 years, precipitated the loss Loita plains migration.

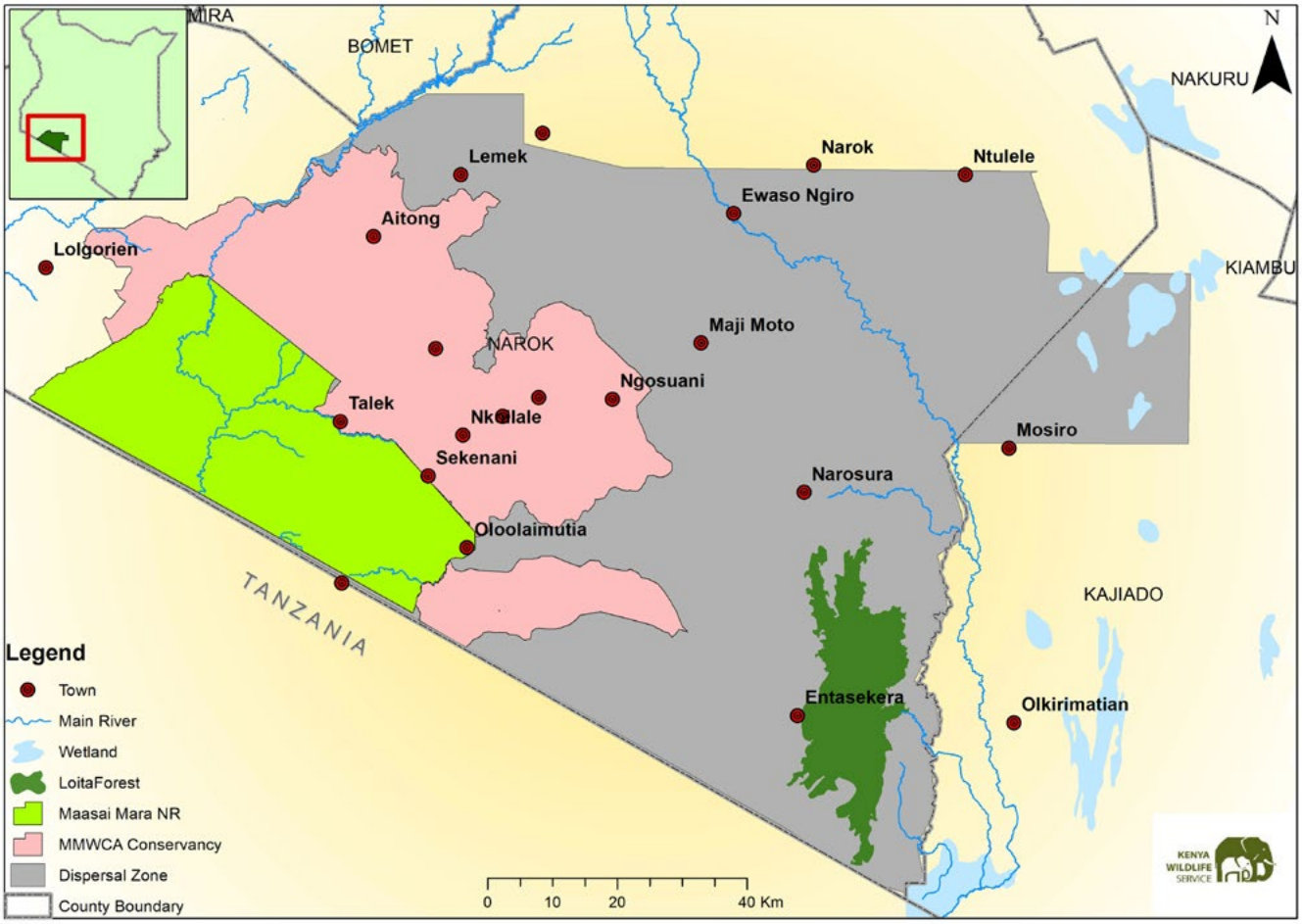


Figure 1: Maasai Mara ecosystem – The Protected Area, Conservancies and dispersal area

Maasai Mara National Reserve (MMNR) hosts all the 'Big five' game animals that include the African elephant *(Loxodonta africana)*, black rhinoceros *(Diceros birconis)*, lion *(Panthera leo)*, leopard *(Panthera pardus)* and large herds of African buffalo *(Syncerus caffer caffer)* that are widely spread across the reserve. The black rhino population was fairly high until 1960s but fell from poaching in the 1970s and 1980s to about 11 individuals in 1984 (Ogutu *et al.,* 2015). Since then the rhino numbers have slowly increased to an estimate of 50 individuals in 2014. Large numbers of Hippopotamus *(Hippopotamus amphibius)* and Nile crocodiles *(Crocodylus niloticus)* are found in the Mara, Talek and sometimes at Olarre Orok rivers during the wet season (Kanga *et al.,* 2011).

The ecosystem holds large groups of antelopes that include, impalas *(Aepyceros melampus)*, bushbuck *(Tragelaphus scriptus)*, Thomson gazelles *(Eudorcas thomsonii)*, topi *(Damaliscus lunatus)*, Coke's hartebeests *(Alcelaphus buselaphus)*, Bohor reedbuck *(Redunca redunca)*, common waterbuck *(Kobus ellipysiprymnus)* and dikdik *(Madoqua kirkii)*. Predators within the ecosystem include; lion *(Panthera leo)*, spotted hyena *(Crocuta crocuta)*, cheetah *(Acynonix jubatus)*, leopard *(Panthera pardus)*, wild dog *(Lycon pictus)* and jackal *(Cannis mesomela)*. The unique islands of bushes (stands) on the Maasai Mara plains are home to the distinctive Maasai giraffe *(Giraffa camelopardalis)*. The rare bat-eared foxes *(Otocyon megalotis)* are also found in the reserve (Thirgood *et al.,* 2004).

The ecosystem hosts a number of threatened species such as the black rhinoceros which is listed as Critically Endangered (CR); ground pangolin (*Smutsia temminckii* CR); lion, elephant, leopard, cheetah and the Maasai giraffe which are all listed as endangered in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. The African wild dog listed as Endangered (EN) and Thomson gazelle listed as Near Threatened (NT) are also found in the ecosystem.

MMNR is an important bird area as it is home to over 470 recorded terrestrial and water-dependent bird species. It also hosts large numbers of migrants and almost 60 species of raptors. Birds recorded in the reserve include Jackson's widowbird, ostrich, secretary bird, marabou storks, hornbills, crowned cranes, long-crested eagles, bustards (black bellied, white bellied and kori bustards), African pygmy falcons, kestrels, hammerkop, plovers, crakes, thicknees, starlings, turacos, weavers, and rollers. Some of the migratory bird species include saddle-billed stork, yellow-billed stork and woolly-necked stork (Verburg et al., 2002).

Savannah grasslands and acacia woodlands dominate the Mara ecosystem. The dominant tree species include Acacia seyal var fistula, *Acacia tortilis, Acacia polyacantha* and *Euphorbia candelabrum* whereas grass species dominating the area are *Eragrostis cyndiflora, Chloris pycnothrix, Pennisetum meziannum* and *Themeda triandra* (Rusch *et al.,* 2005).

The MMNR is primarily open grassland with seasonal riverlets. The undulating savannah alternate with island of bushes predominated by *Croton dichogamus* thickets and *Euclea divinorum*. Grassland plains are mainly dominated by T*hemeda triandra, Pennisetum mezianum, Hyparrhenia species*, and *Eragrostis* sp. The riverine forests that stretch from Lemek through Musiara along Mara River with open perches (glades) toward Olkejuronkai are dominated by *olea* spp and *Rhus natalensis* (Epp & Agatsiva, 1980). *Acacia seyal, Acacia tortilis, Croton dichogamous* thickets and *Euclea divinorum* dominate the dispersal area and the conservancies.

Importance of Corridors

Animals disperse or migrate across landscapes in order to

1. Access vital resources such as pasture, water, and breeding grounds,
2. To reduce the risks of predation and;
3. To enhance genetic health. Migration is essential to the resilience of wildlife populations in the face of spatial and temporally variable rainfall and forage.

Wildlife migratory corridors connect core habitats and can be critical for species' survival and long-term viability of ecosystems. Dispersal between core range areas eases the pressure of high-density wildlife on vegetation and seasonal movements allow recovery between periods of high use. They also increase the effective area available to wildlife and other biodiversity.

Vision 2030 on Securing Wildlife Migratory Routes and Corridors

Kenya Vision 2030 is the long-term development blueprint for the country and is motivated by a collective aspiration for a better society by the year 2030. The aim of Kenya Vision 2030 is to create "a globally competitive and prosperous country with a high quality of life by 2030". It aims to transform Kenya into "a newly-industrializing, middle income country providing a high quality of life to all its citizens in a clean and secure environment".

The Vision is a product of a highly participatory, consultative and inclusive stakeholders' (international and local experts, ordinary Kenyans and stakeholders from all parts of the country) process carried out between October 2006 and May 2007. Between July and August 2007, the contents of the Vision 2030 were again subjected to open consultations in all provinces in Kenya before the document was finalized.

The vision has several pillars namely, moving the economy up the value chain (economic), investing in the people of Kenya (social), moving to the future as one nation (political) and deploying world class infrastructure facilities and services (enablers and macros). This was to be implemented through a series of successive 5-year medium term plans.

The First Medium Term Plan (MTP1) 2008-2012 was the first in a series of successive 5-year medium term plans, which will implement the Kenya Vision 2030. MTP1 identified the key policy actions and reforms as well as programmes and projects that the Kenya Government was to implement in the period 2008 - 2012. The overall objective of this plan was to realize a higher and sustainable growth of the economy in a more equitable environment, accompanied by increased employment opportunities.

Most wildlife corridors and migratory routes have been interfered with by human activities. Strategies will be developed to reclaim them in order for wildlife to continue providing the base for the tourism sector. To prepare physical development plans to map and secure the wildlife corridors and migratory routes to minimize human wildlife conflict. This has been operationalized in the Wildlife corridors report of Ojwang et al 2017. The report identifies certain key corridors especially, of the rangelands and coastal ecosystems. The Impact is reduced human and wildlife conflict.

Need for corridor mapping

The purpose of this project was to facilitate a participatory identification of the wildlife corridors through joint corridor verification field visits and consultation meetings among stakeholders (communities and government agencies). The activity is paramount in securing wildlife habitats to reduce conflict and has the potential to contribute to increased benefit sharing derived from tourism in wildlife corridors. The corridor mapping activity involved identification, marking and prioritizing wildlife corridors in the Mara ecosystem, their importance in wildlife conservation and management in abating human wildlife conflict. From these findings, the information will be taken up and reflected in conservation plans and the ongoing Narok County Spatial plan. The actions will be facilitated to support raising awareness on the importance of conservation of the corridors and connectivity between conservancies.

Mapping Objective

The overall objective of the SEMA project, which is funded by the European Union and implemented by Vi Agroforestry together with her co-applicants and associates is to enhance regional cooperation and partnerships among stakeholders of the Mara-Serengeti Trans-Frontier Conservation Area (TFCA) for improved sustainable management of the TFCA. To attain this the action is facilitating inclusive and participatory decision-making processes and policy dialogue between TFCA stakeholders in Kenya and Tanzania. It is also providing an enabling environment to rejuvenate the political will among key decision makers and institutions towards implementing agreed actions that will lead to improved TFCA ecosystem as well as promote sustainable livelihoods development for local communities. This will be achieved through:

1. Empowering local communities and stakeholders to conserve and protect Mara-Serengeti transboundary ecosystems,
2. Promoting diversified sustainable livelihoods for communities in TFCAs and
3. Promoting regional dialogue, cooperation and community involvement in wildlife law enforcement and management of the TFCA.

Specific objectives

This study aimed to understand current general wildlife movement patterns and compare with previous movements. This would further lead to the assessment of the factors contributing to the drastic change in the movement from the previous to the current scenario:

a. Assess all the wildlife corridor routes and map threats facing their sustainability as future wildlife migratory routes.
b. Identify at least three viable wildlife migratory routes to be secured and conserved as ideal wildlife routes
c. Propose measures to enhance protection and rehabilitation of the identified wildlife corridors
d. Use this information in developing multisectoral and inter-agency mechanisms to protect wildlife movement routes in partnership with the local authorities/communities

2. STUDY AREA AND LOCATION

Location and climate

The Mara ecosystem is in the southwestern part of Kenya and to the north of Tanzania. It falls under Narok County, which borders Kisii, Nyamira, and Bomet counties to the west, Nakuru County to the north and Kajiado County to the east. The study area borders Masai Mara national reserve to the south, wheat farmlands to the north, fragmented wildlife dispersal areas to the east and west along Narok Sekenani road. The dispersal wildlife areas are generally community managed wildlife conservancies where high livestock-wild life interaction is experienced. Some of the community conservancies that were captured in this study are Naboisho, Nashulai, Isateen, Siana, Olarro and Olkinyei.

The ecosystem falls under the tropical savanna, which experiences dry and warm seasons with mean monthly maximum temperatures of 27º - 28º C and mean monthly minimum temperatures of 13° - 16°C (Sinclair and Arcese 1995; Sinclair *et al.,* 2000). Relief and the seasonal movement of global air masses that form the Inter-Tropical Convergence Zone (ITCZ) govern rainfall. This belt of rain-laden winds moves north and south across the equator. The rains are bi-modal in nature, received between March - June and November - December, although the timing varies with location. The Mau complex to the north receives the highest rainfall with mean annual of 1000 - 1750 mm while the middle ranches (Lemek area) receive mean annual rainfall of 900 - 1000 mm. The rest of the lowland areas receive mean annual rainfall of 500 - 800 mm. High rainfall in Mau forest sustains the Mara river which is the main supply of surface water to the Mara ecosystem both for humans and wildlife. Other important drainage systems in the ecosystem include Sand River, Talek and Ewaso Nyiro Rivers.

Topography and soils

The topography and soils of the Mara-Serengeti ecosystem are explained in detail in the Serengeti - Masai Mara trans-boundary protection and monitoring plan (EAC, 2010). The basement complex of the ecosystem is composed of very old igneous and metamorphic rocks of pre-Cambrian age. The present topographic forms characterized by extensive plains, hill crops as well as escarpments and valleys are as a result of erosion and volcanic activities that have changed the surface of this ecosystem. Rich volcanic soils are found in the rangelands and escarpments whereas poorly drained brown soils occur in the plateaus and plains where extensive grasslands are common. River basins and valleys have clay soils enriched with accumulated sediments (Ogutu and Smith, 2003).

In the Maasai Mara, soil types are gradually shallow, sandy and rocky with volcanic deposits dominating some places. Brown clay soils are seasonally waterlogged but are better drained towards the south. Central plains are characterized by alkaline soils derived from tertiary volcanic activities in the Mau range. Dark red clay soils occur in the southeastern parts of the ecosystem.

Land use

The Mara ecosystem is characterized by several land use patterns top of which is tourism within the reserve and adjacent areas. Private and community conservancies, community ranches and expansive crop production farmlands surround MMNR. Livestock keeping is also a key economic activity commonly practiced in this region where local communities keep cattle, sheep and goats. The ecosystem is characterized by significant expansion in farmlands and settlements, which now occupies areas that were previously natural grasslands, and were used by wildlife for dispersal, breeding and/or calving (Ndegwa and Murayama, 2009).

Considerable changes in terms of land cover - land use and land tenure have occurred in the Mara ecosystem. The major land use changes started in the early 1960s. At this time, the ecosystem was less populated and the land was exclusively used for nomadic pastoralism, livestock and wildlife grazing. Large pieces of land have been converted from pastoralism to crop cultivation, mainly commercial wheat farms thus displacing wildlife and alienating their habitats. Production of charcoal has also been taking place resulting into habitat degradation and increased human wildlife conflicts (Balmford *et al.,* 2001). The socio-political setup of the ecosystem is rapidly changing and competition between pastoralism, agriculture, tourism and conservation is becoming evidently present. These land use changes characterized by increased farmlands, emerging fences and growing human settlements have led to decline in some wildlife species hence requiring concerted conservation efforts to avoid species extinctions (Brooks *et al.,* 2002). Habitat loss has already been observed to lead to the decline of endangered African wild dogs *(Lycaon pictus)* (Gorman *et al.,* 1998).

Currently, Narok town is the biggest urban center in the Mara ecosystem. Other small trading centers and market places are sprouting adjacent to the MMNR entry gates, within the conservancies and in the wildlife dispersal areas leading to increased populations.

Increase in fences, settlements and agriculture/cultivation have displaced most of wildlife in the community lands while livestock seems to have a negative impact to wildlife in the community conservancies and in the reserve.

Social economic activities

The main economic activities within the core conservation area is tourism whose main sources of income include the hotel industry, curio shops, campsites, game drives and hot air balloon safaris. Wildlife conservation and tourism activities are the only land uses permitted within the MMNR and Mara Triangle. Within the conservancies, a blend of tourism and pastoralism dominate the people's livelihoods. The Zebu is the main breed of cattle reared though in the recent times Sahiwal breed has been introduced, with other livestock kept being sheep, goats, and donkeys. The community also practices poultry farming and bee keeping. In the dispersal areas, pastoralism and crop cultivation are practiced as economic and livelihood activities in the high-altitude areas with high rainfall and fertile soils. Wheat and maize are the major crops although barley, beans, potatoes and horticultural vegetables are also grown along the riverine areas and water springs. Quarrying and sand harvesting are other forms of economic activities practiced in the dispersal area.

Wildlife trends

According to a recent study by Ogutu *et al.* (2016), the population estimates for wildlife and livestock in 20 counties in the Kenya rangelands between 1977 and 2013 show a striking increase in numbers of shoats and camels, and concurrent extreme declines in the numbers of 15 of 18 common wildlife species. The aggregated numbers of sheep *(Ovis aries)* and goats *(Capra a. hircus)* across the rangeland counties increased markedly by 62%, followed by 20% for camels *(Camelus dromedarius)* and 1.2% for donkeys *(Equus asinus)*, while the number of cattle *(Bos taurus)* dropped by 30%. In sharp contrast to the increasing trends or moderate declines in livestock numbers, the aggregated numbers of the common wildlife species declined precipitously, and for certain species catastrophically, over the same period. Patterns of different wildlife species have for long been showing dynamism in population trends. Elephants and Giraffes have shown continuous increment in the ecosystem (Kuloba *et al.* 2010, Kiambi *et al.* 2012, Kyale *et al.* 2014, Mwiu *et al.* 2017) (Figure 2). Giraffes have secured a good foraging and conducive habitat outside the Protected Area (PA) despite increase in fences and privatization of land in the community conservancies (Mwiu *et al.* 2017).

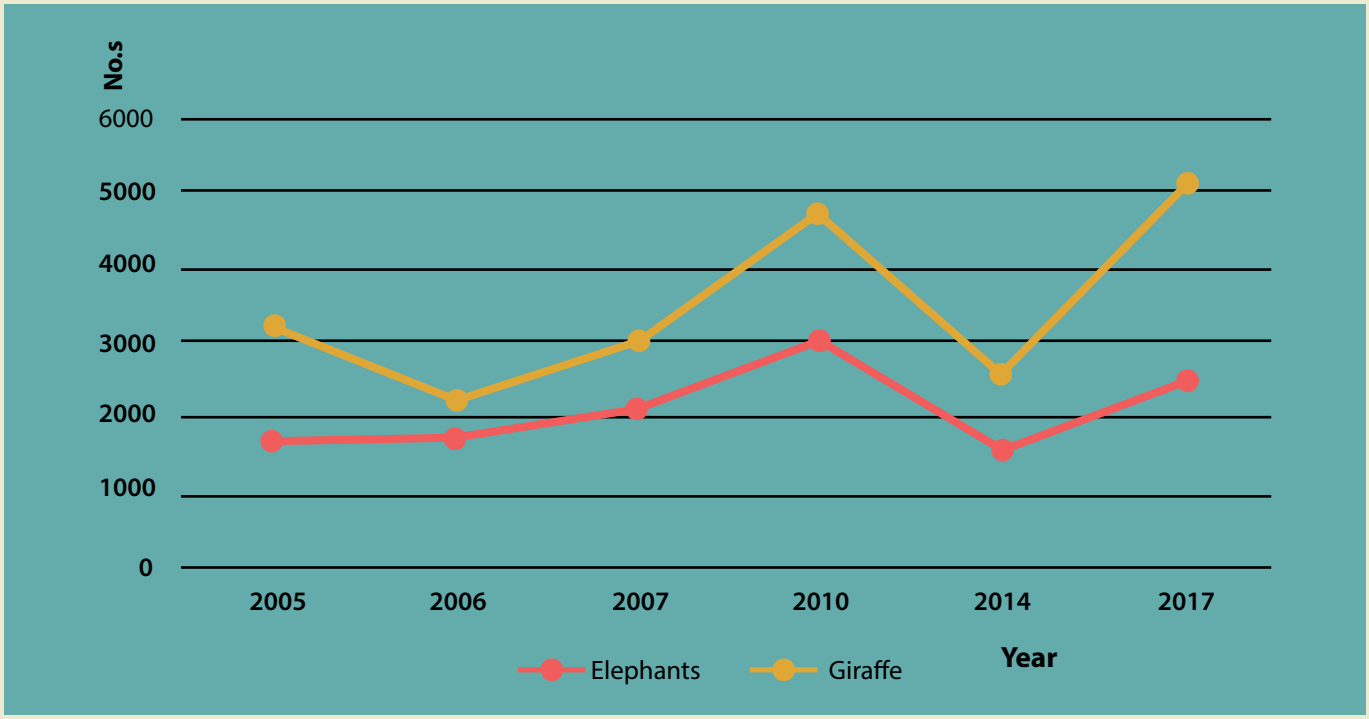


Figure 2: Population trends of elephants and girraffe: Source Mwiu *et al.* 2017

Wildlife movements, dispersal and migration

Vision 2030 identifies securing of wildlife dispersal areas and migratory corridors and pathways as significant ingredients of sustainable eco-tourism. Likewise, it is upon KWS and respective multisector conviction that the protection of wildlife habitat and corridors can help to secure Kenya's natural resources and with them, her national interests related to tourism, biodiversity, sustainable use of resources and community livelihoods. Land use modification, human and livestock population increases, and changing settlement patterns form the context of the current and future elephant and other wildlife movements' picture. The consequence is that elephants must seek grass south of the extent of livestock grazing inside the MMNR or move beyond its boundaries.

Key areas of wildlife dispersal in Mara ecosystem are;

a. Oldonyo rinka dispersal areas wildlife movements towards Maji moto to the Loita regions and back.
b. Olkinyei conservancy wildlife movements to Olarro conservancy and Naikara regions towards Morijo and back.
c. Nashulai conservancy wildlife movements through Isateen and Siana conservancy to Olderkesi and Olposimuru-Loliondo region of Tanzania.
d. Masai Mara National Reserve wildlife movements through sand river towards Mara river to Serengeti national park region that extends to Ngorongoro conservation area and back.
e. Mara conservancy wildlife movements to Mara north conservancy towards Oloisukut and to Nyakweri forest and back.

Field data collection

Data collection was carried out in two phases:

Phase 1: Digitization of wildlife corridors

A team of experts consolidated corridor information and spatial data from various sources. Some of the data sources included Mara Elephant Project (MEP), Kenya Wildlife Trust (KWT), African Bio-services project and Kenya Wildlife Services Central Database. Data on human settlement (both temporary and permanent), fences, farms, roads, urban centers and other infrastructural footprint in the ecosystem were digitized in form of points, lines and polygons from orthophotos and Google Earth images. These data were later collated with collared elephant, wildebeest, lion and cheetah movement data and distribution. These species have been studied to give insights in the movement and habitat use of herbivores and carnivores respectively.

The product of these were GIS shape files of human settlement, roads, fences, centers, crop farms, conservancies, Protected areas and elephant, lion and cheetah movement maps. The maps helped in identification of various wild animal corridors in the ecosystem and aided in picking out the most critical corridor among them all.

Based on the information, the team focused on threatened crossing points (wildlife routes) along the Narok - Sekenani road. The identified corridors were major routes connecting Nashulai and Siana Conservancy, Naboisho and Siana/South Olarro conservancies and Olkinyei – Olarro conservancies. The common barrier between these conservancies is the Narok-Sekenani C-12 road which is currently undergoing tarmacking. The team identified 9 corridors across the section of the road between Loita plains and Sekenani gate.

Phase 2: Field data collection and ground truthing

This is the second phase which involved field data collection and ground trothing on the identified 9 corridors with an aim of prioritization. The team composed of ecologists, GIS expert and community warden walked through the identified corridors and collected more data on wildlife and other natural parameters, and anthropogenic features which included settlement (both temporary and permanent), fences, crop farms, schools, tourist camps, domestic animals, logging, mining and charcoal kilns and other infrastructural activities along the corridors. During the exercise data on all wildlife species encountered, invasive species, presence of natural water points, elephant dung/ prints, habitat condition and other wildlife information were recorded. The team further documented the status, land use and feasibility of securing the corridors.

3. RESULTS AND DISCUSSION

Mara Wildlife Dispersal Areas

Wildlife in the Mara ecosystem utilize the Protected Area (PA) namely the Maasai Mara National Reserve (MMNR) and Mara Triangle (MT) and the adjacent community conserved areas. The conservation areas outside the PA include several community and private conservancies demarcated from the former larger group ranches that are at various intermediate and advanced stages of land sub-division for conservation and human habitation. Elephants, a keystone species roams across these areas including human dominated areas in search of pastures and habitable space (Figure 3).

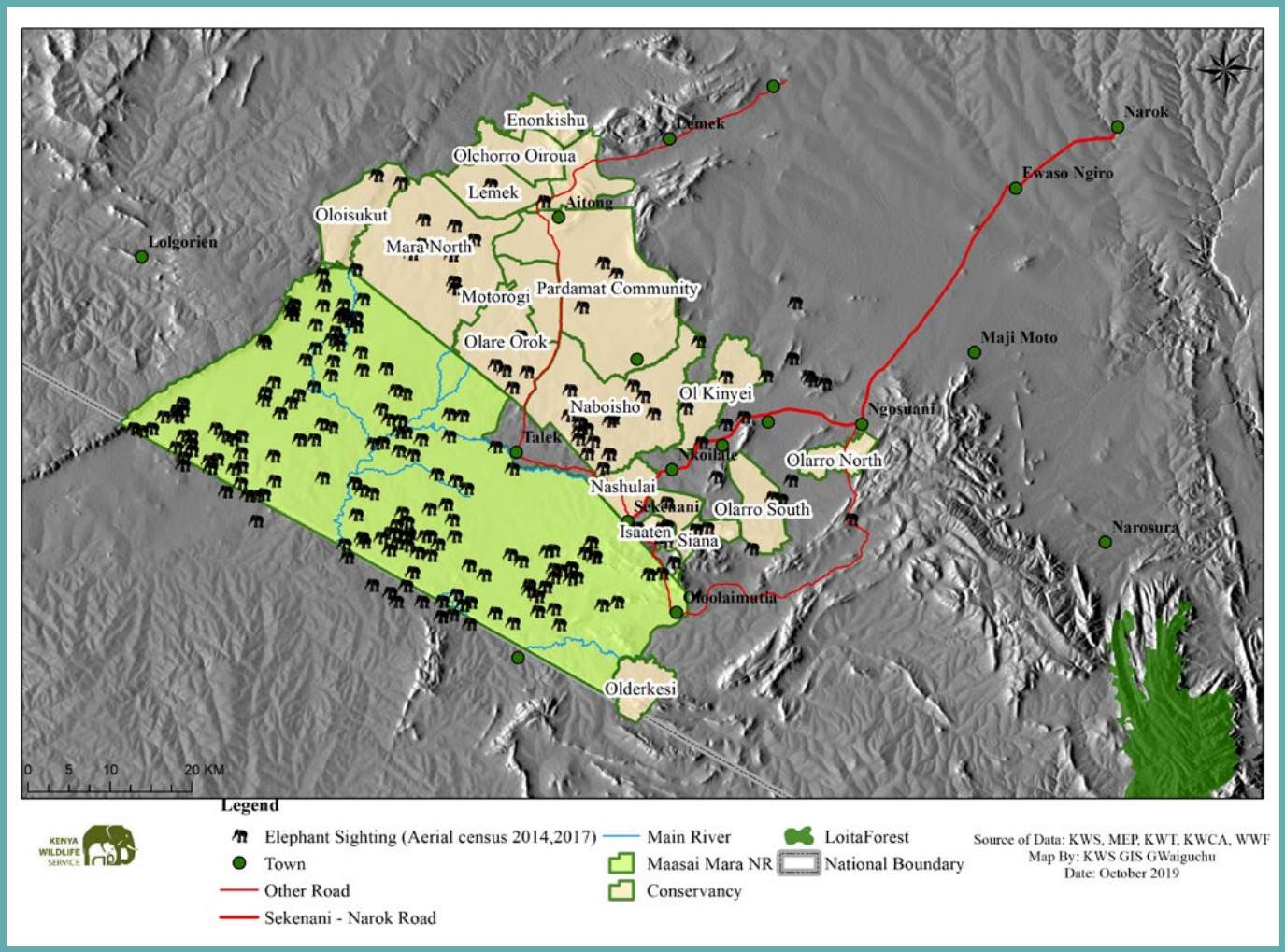


Figure 3: Map of elephant distribution across the Mara ecosystem

The Mara ecosystem is famously known for having the highest density and most diverse combination of large herbivores. Apart from the wildebeests, which are known for their seasonal migration between the Mara and Serengeti plains and between the Mara and loita Plains (Ogutu et al., 2005). Elephant for example roam across the ecosystem traversing through the conservancies (Mara North, Pardamat, Olare Motorogi, Olare orok, Olarro, Naboisho, Olkinyei, Lemek, Enoonkishu, Siana, Olderkesi) into human dominated areas of Naikarra, Suswa, Loita and Transmara and across international boundary too deep into Serengeti National Park and adjacent areas (Figure 4).

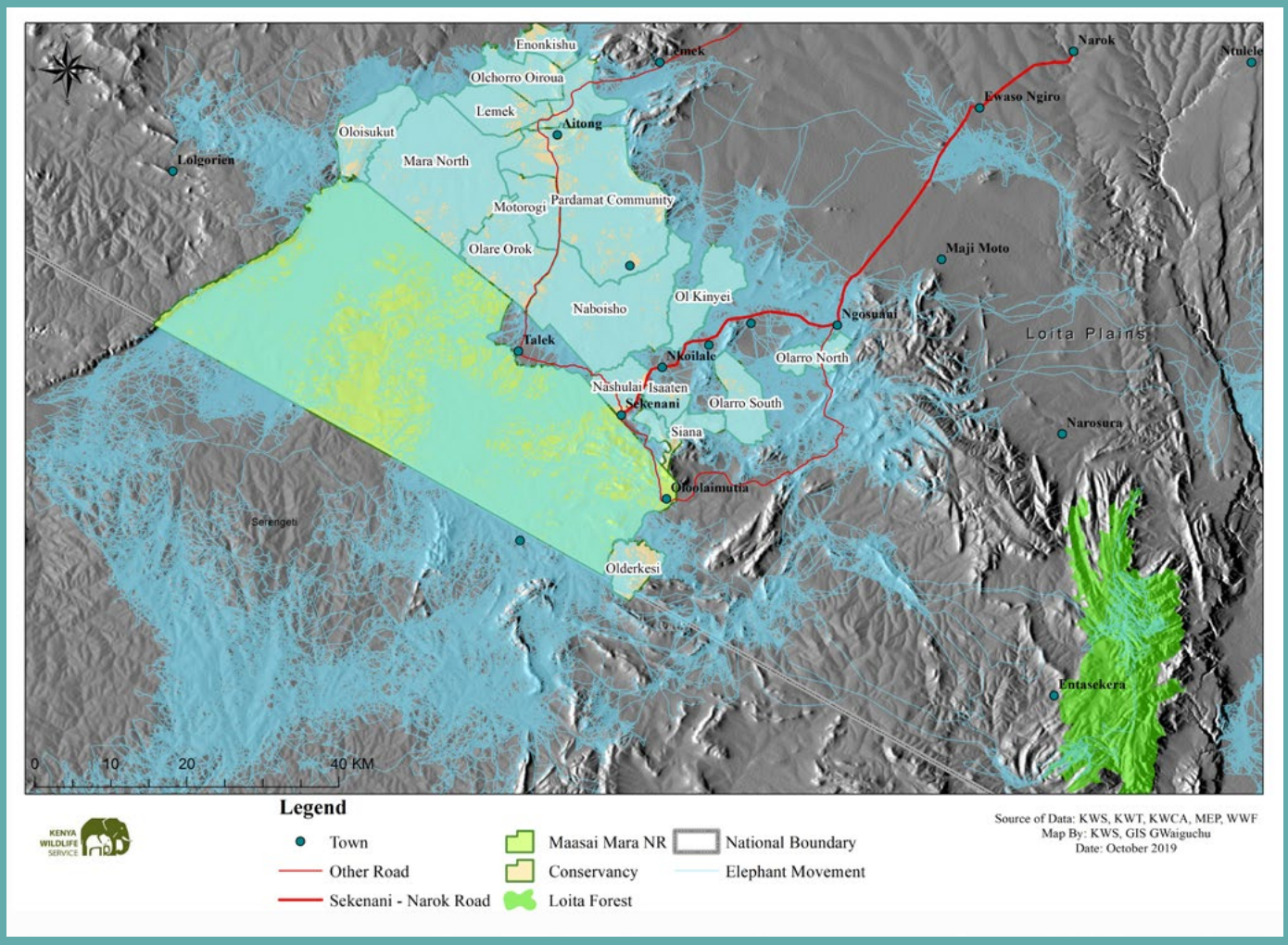


Figure 4: Map showing elephant movement across the ecosystem.

Migratory Routes/Corridors

From the wildlife movement and distribution there are currently about 18 wildlife routes which act as links/connections between conservancies and Protected Areas (Figure 5).

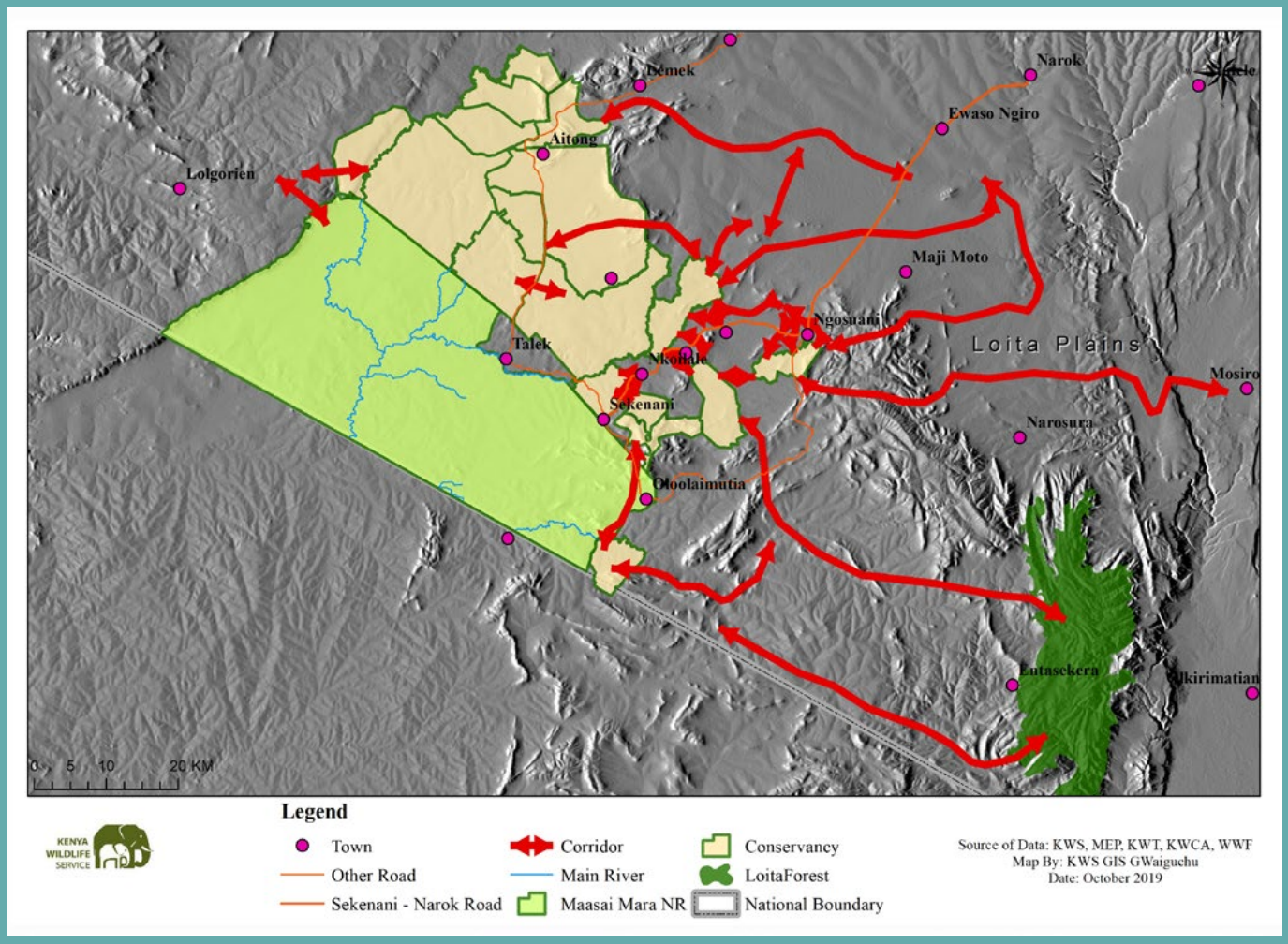


Figure 5: An overlay of various wildlife routes and corridors

Out the 18 corridors across the Mara, nine wildlife routes run across the Narok-Sekenani road at different sections connecting the conservancies through areas of high human development potential (Figure 6). The nine corridors were extensively mapped and various data on their current status collected and analyzed. This report focuses on corridors crossing the Narok-Sekenani road due emerging threats from human infrastructure development, driven by the recent conversion to tarmac and accelerating along the road.

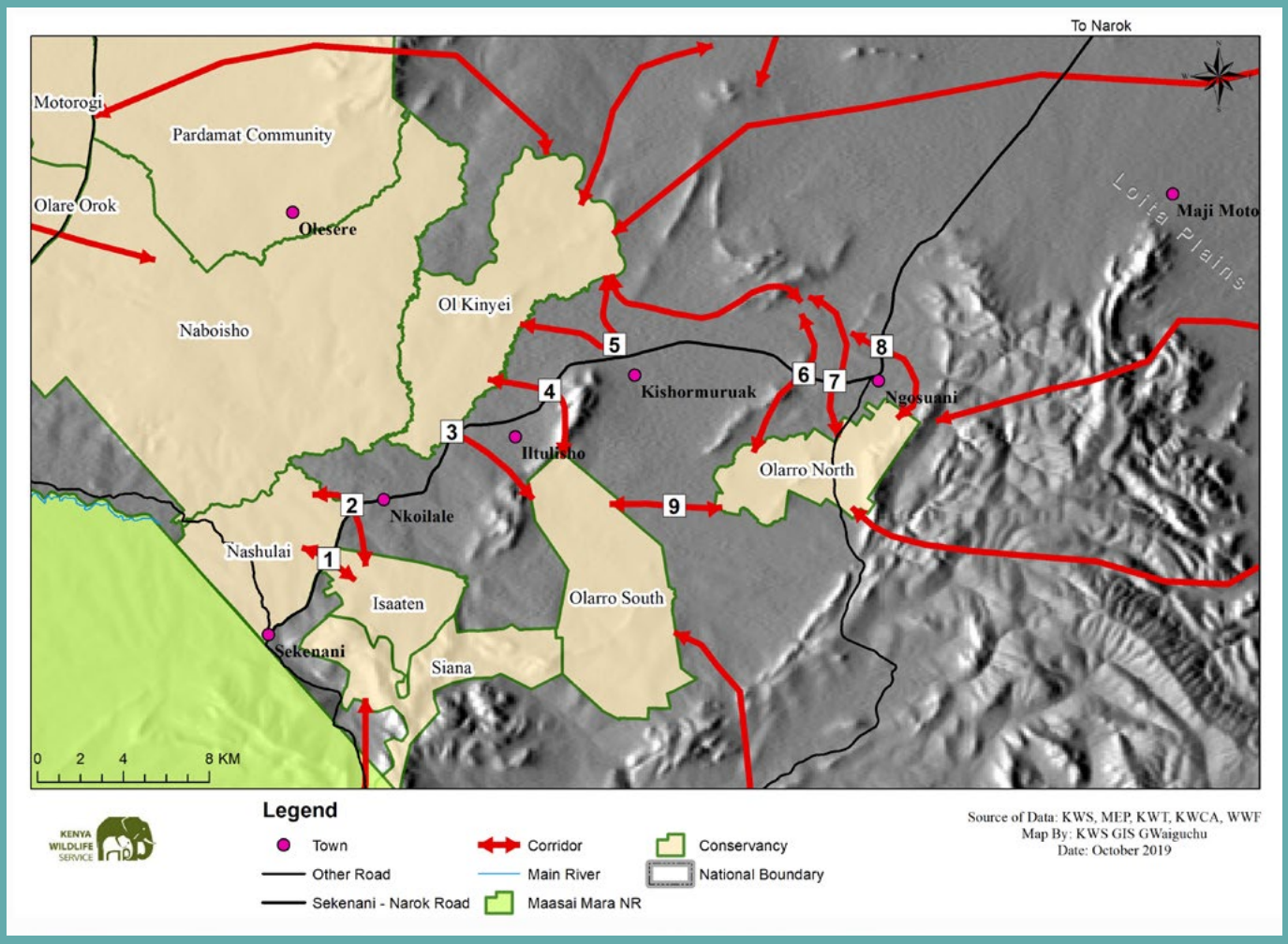


Figure 6: Wildlife corridors across Narok - Sekenani road

The upgrade of the road has resulted to change of land ownership and land use and further leading to proliferation of other barriers such as permanent settlement and electric fences thus blocking wild animal movements between the conservancies (Figure 7).

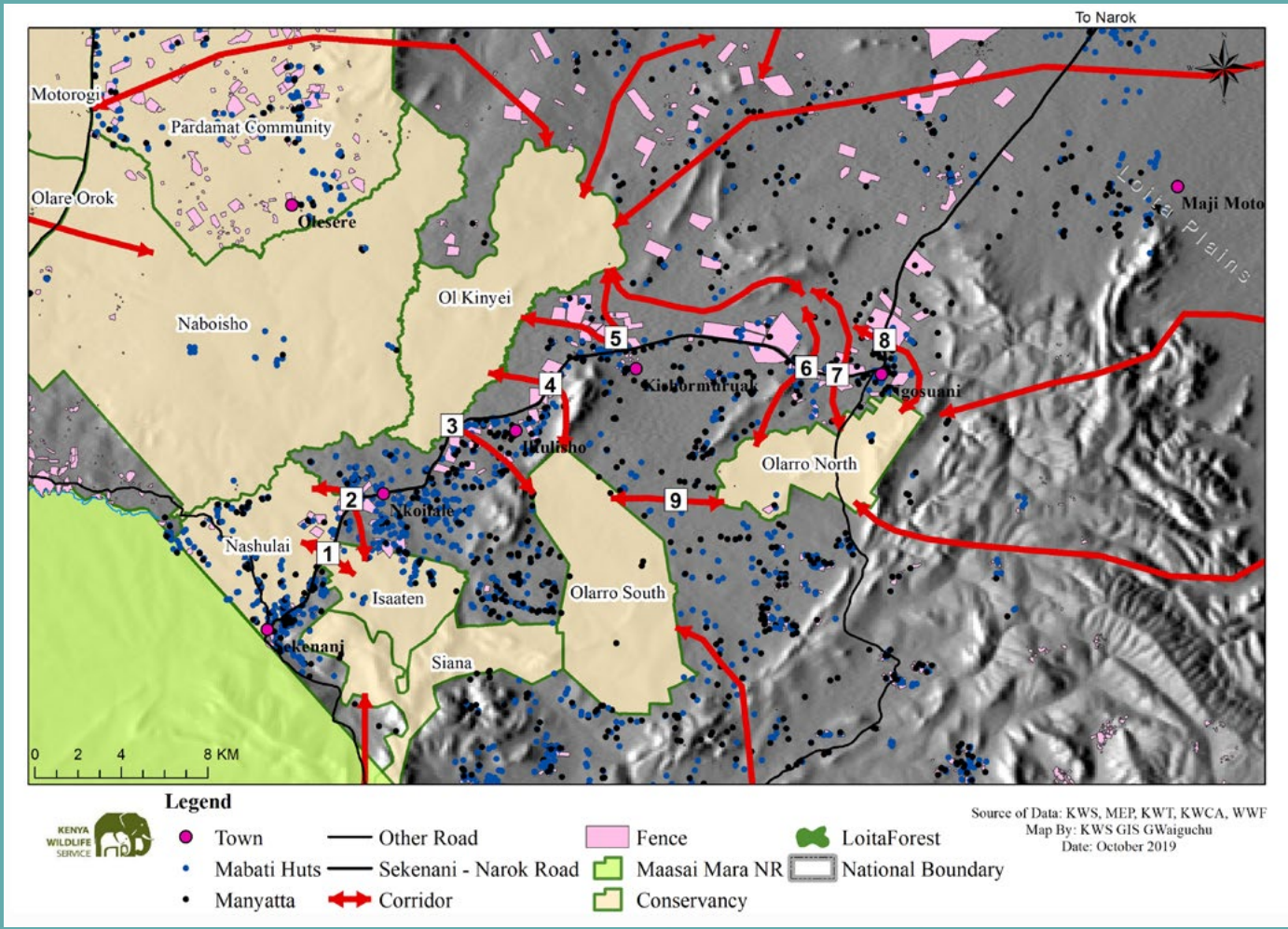


Figure 7: Wildlife corridors, human settlement and other infrastructure along Narok - Sekenani road

Description of Wildlife corridors across Narok - Sekenani road

Corridor 1: Nashulai and Isateen Conservancies

The corridor connects the newly established Nashulai and Isateen conservancies that are separated by the upgraded Narok-Sekenani Tarmac road. The Nashulai conservancy extends to the west to join Naboisho and it came in time to secure the previously lost corridor. The east boundary touches the Narok-Sekenani road. Similarly, Isateen joins Siana conservancy to the east and touches the road to the west connecting well with Nashulai. Elephant signs along the route indicate that they use this route to reach other far conservancies of Siana and Olarro. The newly upgraded road and emerging settlement along tarmac road are main barriers on the corridor. Currently there is no fence blocking the corridor (Figure 8).

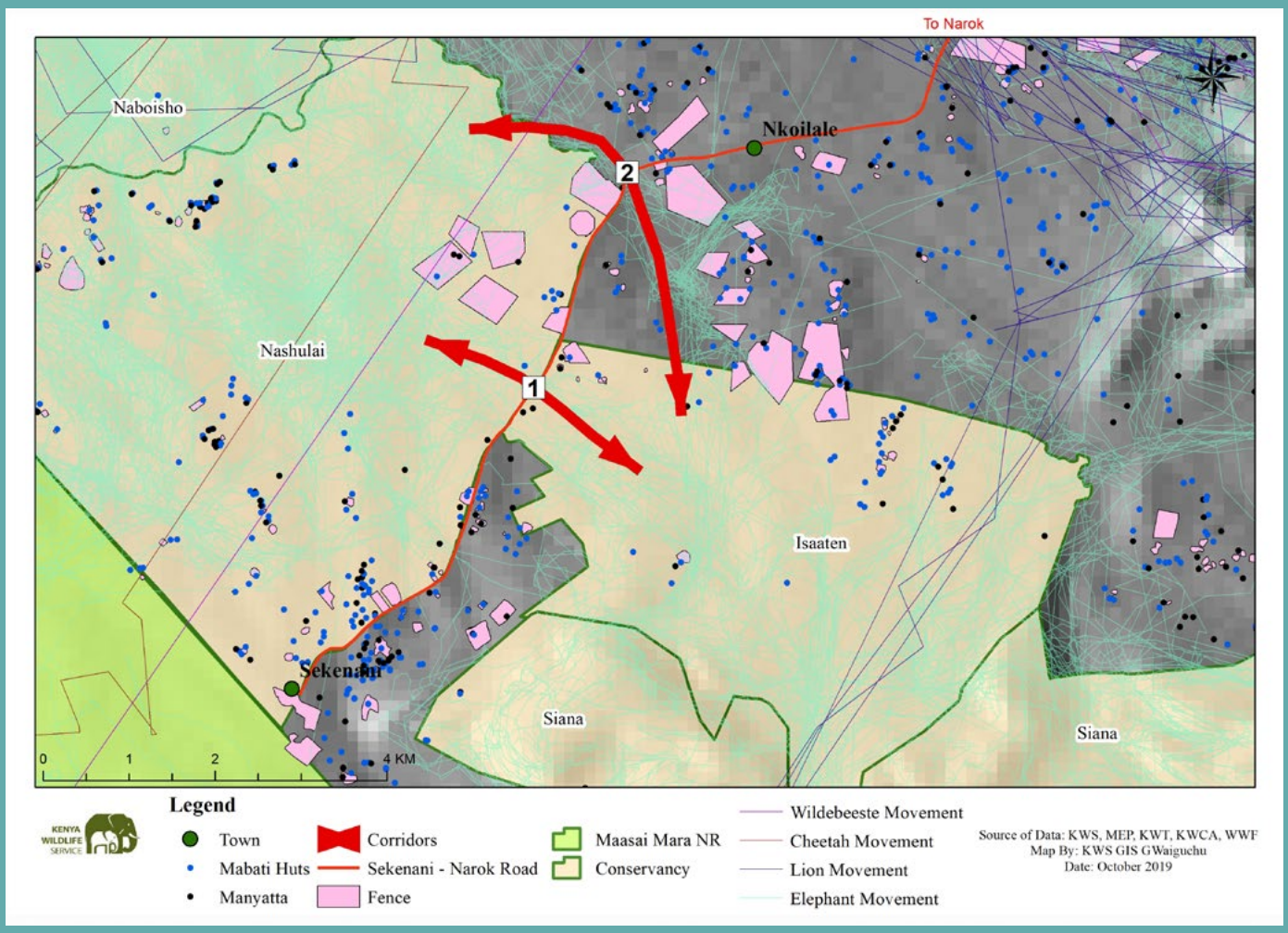


Figure 8: Corridor 1 and 2 linking Nashulai and Isateen conservancies

Corridor 2: Nashulai and Isateen through community lands

This route runs along the Talek River from the northern side of Nashulai conservancy. It follows several different luggas across private land and across the Narok-Sekenani road. This corridor loops from the northern boundary of the two conservancies through a bridge. The use of this route has resulted to several cases of conflict between elephants and the individual landowners. The main barriers to the movement of elephant, lions and wildebeest in this corridor are more than seven individual fences, the tarmac road and permanently built houses. This corridor runs approximately 3km across community land (Figure 8).


Photo by Kent Larsson

Proposed Interventions for corridors 1 & 2

Corridor 1

- Need to mitigate against the negative impacts of emerging development interventions such as fencing within both Nashulai and Isateen conservancies, settlements along the road within the corridor section among others.
- Erect speed bumps and signage on the road at the start and end of the corridor section
- Border between Naboisho and Nashulai should be kept open for free movement of wild animals

Corridor 2

- Need for community sensitization and mobilization to join conservancy model
- Mitigate against the negative impacts of emerging fences and settlements along the roads and near the established conservancies
- Erect speed bumps and signage on the road section and near the bridge
- Discourage new settlement along the conservancy boundaries

Corridor 3: Ol Kinyei and Olarro Conservancies

A main elephant route used during day and night between Mara Naboisho/Ol Kinyei Conservancies and Olarro Conservancy. The route emerges from Olkinyei and Ropili River intercept and follows the the river eastwards to Olarro conservancy. The route requires elephants to cross the main Narok-Sekenani road, at the side of a bridge and through an individual dilapidated fenced land which act as the main barriers to the movement of elephant and wildebeest. The carnivores use the same route but they are able to pass under the bridge and through the fences.

This route requires elephants to move along the seasonal river and through private land that is being fenced to the river's edge but leaving an edge of about 30 meters on one side. This is a very important corridor in need of urgent protection as it connects the western conservancies to Siana, Olarro and the Loita Hills and is being rapidly settled. The corridor cuts across community owned land for about 4km in length with five fences (Figure 9).

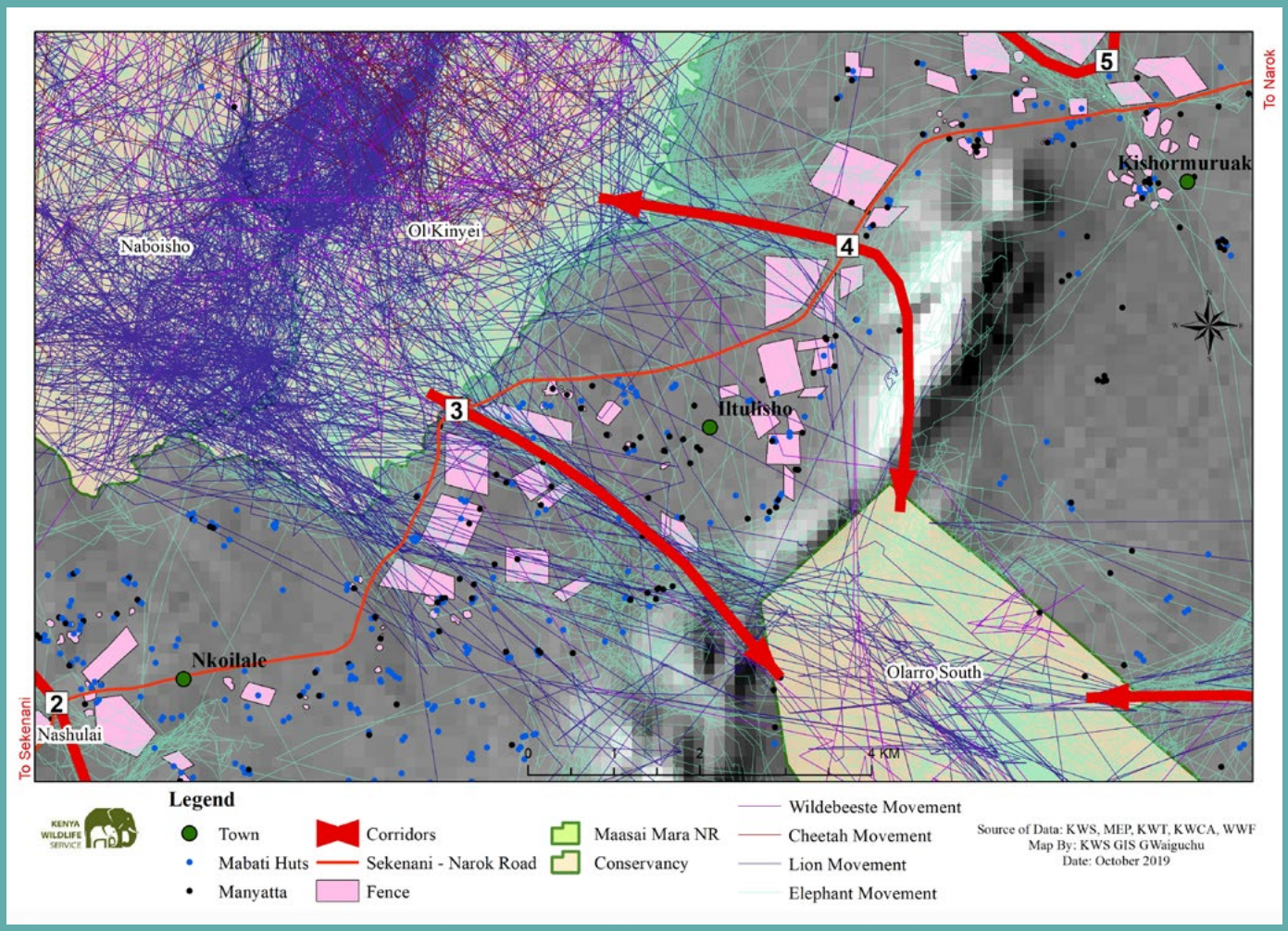


Figure 9: Corridor 3 and 4 linking Olkinyei and Olarro conservancies

Proposed Interventions for corridor 3

- Need to mitigate against the negative impacts resulting from development initiative such as fencing widen the corridor to 1km wide on both sides of the river
- Discourage settlement along the corridor
- Since water is a common resource for both wildlife and human on the corridor, there is need for construction of water pans that can serve human away from the river.

Corridor 4: Olkinyei and Olarro South Conservancies

This corridor connects Olkinyei and Olarro South through the hills. The route curves to the north of Ilturisho community settlement. Main barriers are the tarmac road, settlement and several fences. The corridor stretches approximately 5.5km and passes through a community settlement.

Corridor 5: Olkinyei to Kishormuruak salt lick

This corridor follows a riverline habitat from Olkinyei Conservancy to Kishomuruak. The corridor has been completely blocked by human settlement at Kishormuruak center. Currently, elephants move to a salt lick near Kishormuruak center and then make a U-turn back to Olkinyei conservancy. The corridor does not have a direct link to Olarro conservancy based on the collared animal movements. The corridor is approximately 7.7km length looping again through highly fenced community owned land. Main barriers are settlement, fences and the main Narok - Sekenani tarmac road (Figure 10).

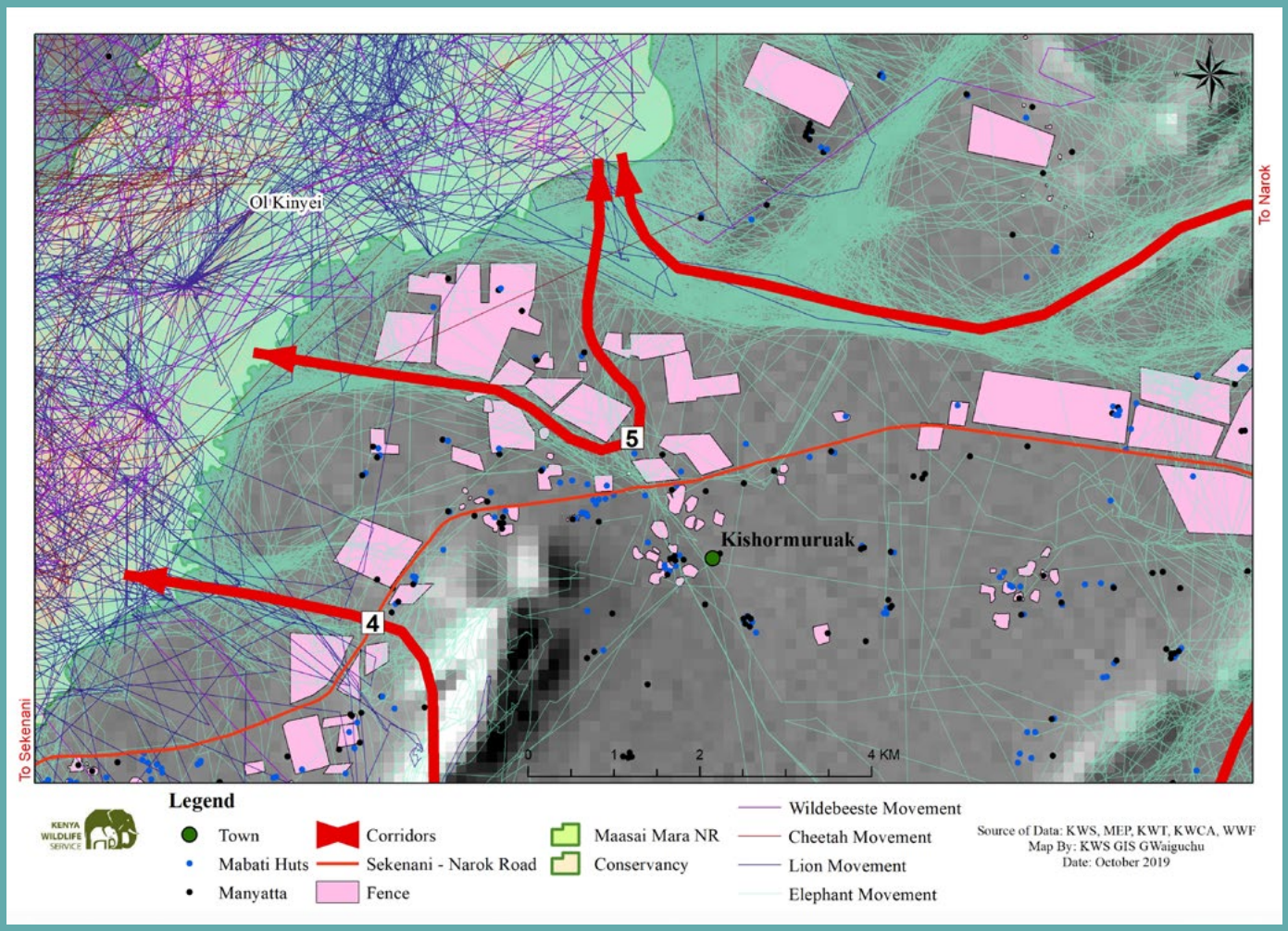


Figure 10: Corridor 5 from Olkinyei to Kishormuruak salt lick then back to Olkinyei

Proposed Interventions for Corridor 4 & 5

- Riparian protection and easement to widen the corridor to about 1 km on either side of the river
- Discourage erection of fences
- Community sensitization and education awareness.

Corridor 6, 7 and 8: Ol Kinyei and Olarro Conservancy

Between Ol Kinyei and Olarro North Conservancies, elephants follow several primary routes marked as route 6, 7 and 8. From Olarro North Conservancy the elephants take three paths: two paths to the south west of Ngosuani center (Route 6 and 7) and one path to the north of the center (Route 8) and merge within individual parcels of land, which has been a critical elephant habitat over the years and not yet established as a conservancy. The route then extends westwards into Olkinyei conservancy through Endoinyo Namankewon and Shangalera rivers. Elephants are also attracted to the dispersal area by the unsettled hilly expansive area with few settlement and fences and Olare Lemuny salt licks (Figure 11).

The area around Olare Lemuny salt licks which connect to Ormuntorobi Hill south of Ngosuani center is being rapidly settled and land large fences coming up at an alarming rate (Route 7). All the routes in this corridor must cross the main Narok-Sekenani road, which is already a barrier to elephant family groups and has been upgraded to tarmac road.

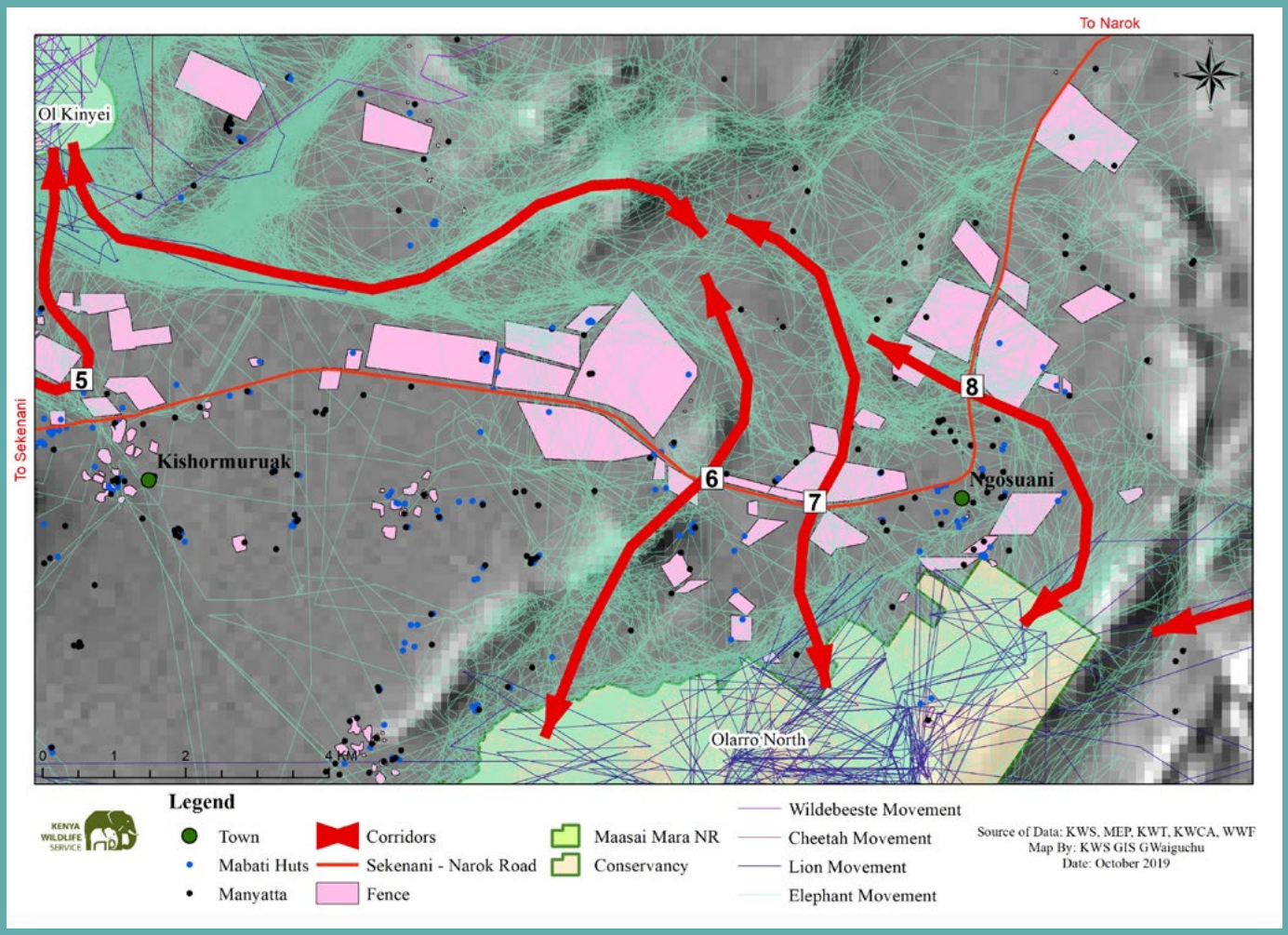


Figure 11: Corridor 6, 7 and 8 connecting Olarro North to Olkinyei Conservancy

Proposed Interventions for Corridors 6, 7 & 8

- Discourage fencing and permanent settlement especially on corridor 6 and 8
- Establishment of a conservancy north west of Olkinyei conservancy
- Mitigate against the negative impacts of fences along the highway and mostly on corridor 6 and 8
- Erecting speed bumps and signages at the crossing points before and after Ngosuani center

Corridor 9: Olarro South and North Conservancy

The recent extension of Olarro Conservancy (Olarro South and North) forms a critical link to securing the passage of elephants between the core Mara population and the Loita Hills. However, until the gap between Olarro South and North corridor is formalized the connectivity between the conservancies east of the Narok-Sekenani road will still be a challenge. The main barrier in this route are numerous fences and human settlement (Figure 12).

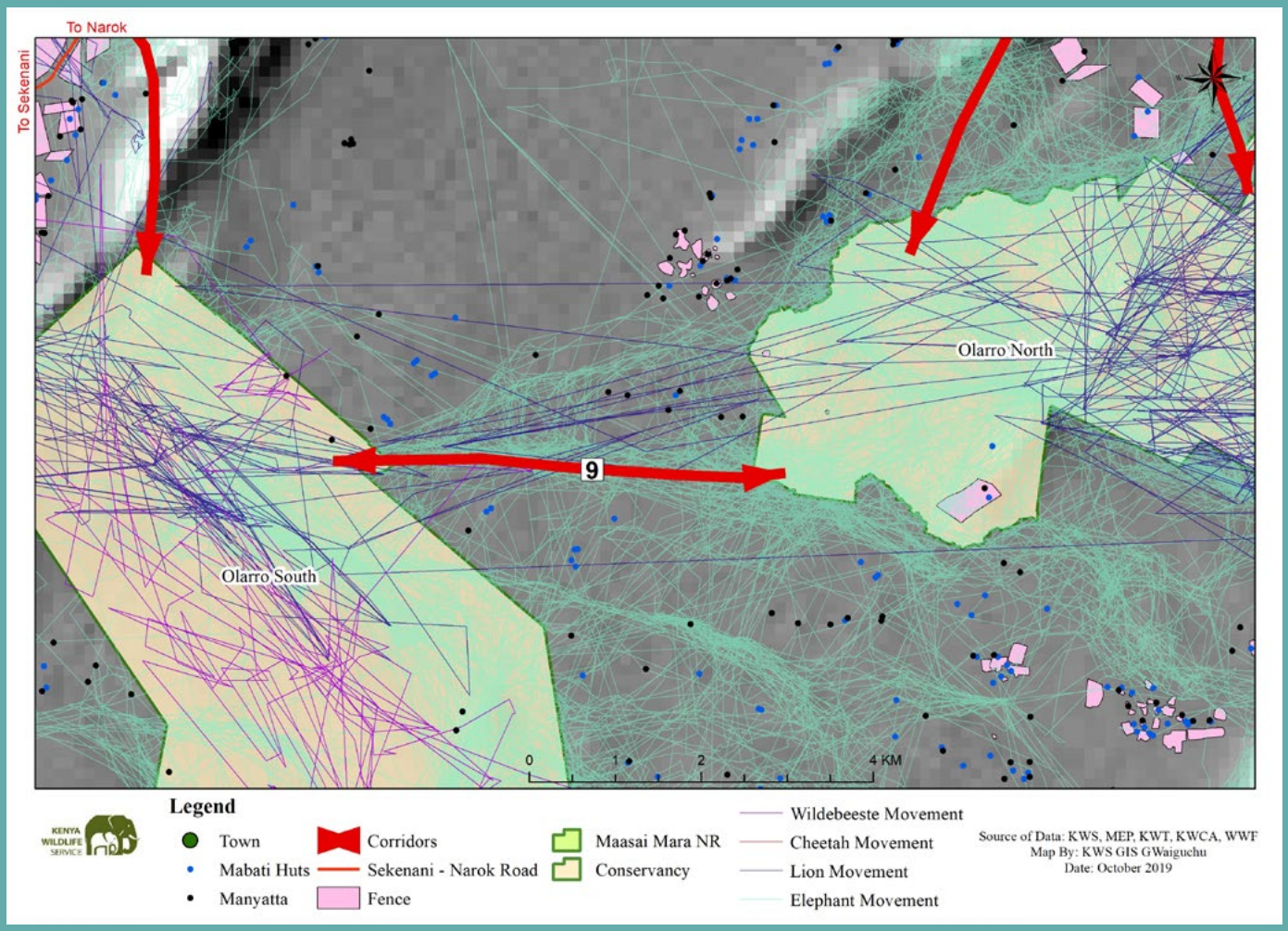


Figure 12: Corridor 9 linking Olarro South with Olarro North

Proposed Interventions for Corridor 9

- Community sensitization, education awareness which should be the key priority measure in ensuring fences are not erected along the corridors.
- Riparian protection; through identification of water harvesting methodologies and practicing of minimum tillage or no tillage.
- Construction of water pans for maximizing water supply to the community which could be geared towards reducing human wildlife conflict in the watering points
- Discourage settlement along the established corridor
- Hold Community dialogues on ways of easing Human Wildlife Conflicts in the area.

4. CONCLUSION AND RECOMMENDATION

Corridor Prioritization

The eight corridors identified along the Narok-Sekenani road were subjected to a prioritization matrix. The corridors were prioritized based on various attributes. Attributes which may have positively influenced the corridor included presence of elephant dung of different classes ranging from A (Fresh) to E (Very old), proportion of wild animals sighted within 200 meters and water availability. Those attributes which negatively impacted on the corridor included presence of livestock, permanent mabati roofed or concrete houses, grass thatched or cow dung huts (Masai Boma), threats such as charcoal and logging, presence of alien invasive plant species and presence of fences (electric, plain and barbed wire). All the eight corridors were subjected to the matrix and the result tabulated in Table 1 below.

Corridor ID	Elephant dung	Proportions of wild animals	Proportion presence of water	Proportion No. of livestock	Proportion Mabati huts	Proportion Temp. settlement	Proportion Threats	Proportion invasive species	Fences	Total Marks	Ranking
Ideal	**20**	**20**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**43**	
1	7.50	10.89	2.32	-0.91	-0.45	-0.10	0.00	-0.71	0	18.54	**1**
2	7.00	2.97	2.47	-0.51	-1.15	-0.51	0.00	-1.07	-7	2.21	**4**
3	5.13	5.24	1.16	-1.03	-0.38	-0.51	0.00	-0.71	-5	3.89	**3**
4	4.38	2.82	1.32	-0.87	-0.77	-2.37	-0.63	0.00	-5	-1.13	**6**
5	10.88	3.76	2.32	-1.83	-0.77	-0.10	-3.75	-3.57	-15	-8.07	**8**
6	7.38	9.14	2.55	-1.53	-2.69	-5.30	-0.63	-1.07	-3	4.84	**2**
7	4.38	5.02	2.63	-0.89	-2.05	-0.76	-3.13	-0.71	-8	-3.51	**7**
8	7.38	4.16	1.24	-2.43	-1.73	-0.35	-1.88	-2.14	-5	-0.76	**5**

Table 1: Scoring matrix results for the entire eight corridor across the Narok - Sekenani road

After scoring, corridor 1 scored the highest and much above the rest. The corridor has few barriers and the main barrier between the conservancies is the main road and few emerging settlements with fences.

Corridor 6 came second in the ranking while corridor 3 came third. Corridor 5 scored poorest because it has been cut off by high settlement and loops by the road back to Olkinyei Conservancy. Corridor 8 which by wildlife movement data is very active, it's under immense pressure from emerging fences and expansion of Ngosuani center.

Conservation Connectivity Threats in the Mara

The following were identified as the main threats to wildlife and habitat connectivity in the Mara ecosystem:

- Farming along the streams and riparian zones
- Land fragmentation and competition from livestock
- Land use change from pastoral to crop farming and demarcation to individual small parcels
- Change of land tenure from the local residents to immigrants
- Change of land ownership through sale of land to developers
- Permanent settlement on wildlife areas
- Killing of wildlife through retaliatory killings and bushmeat
- Erecting fences resulting in habitat fragmentation, blockage of movement routes, escalation of HWC
- Proliferation of invasive species due to land degradation
- Intentional poisoning of wildlife using farm herbicides to deter wildlife from individual land
- Logging and charcoal production
- Rivalry among investors
- Infrastructure development – New tarmac road, power lines, schools, expansion of market centers, unplanned tourist facilities along wildlife habitats especially riparian areas

Recommended Interventions

The following were recommended as feasible interventions towards securing and conserving the wildlife corridors along the Narok - Sekenani road:

- Securing corridor through establishment of conservancies especially the area north west of Olkinyei, east of Olarro and Siana conservancies and areas around Naikara and Olderkesi
- Securing corridor through leasing of land especially on corridor 3 which connects Olkinyei and Olarro conservancies
- Spirited campaign to mitigate against the negative impacts of development activities such as fences and moats across wildlife dispersal area
- Conflict resolution mechanism among stakeholders
- Finalize and actualize the implementation of Narok County Spatial plan
- Encouraging investors to support the established conservancies and support environmentally sound activities on key wildlife habitats – riparian areas
- Make use the existence of a coordination framework for all conservancies; the Maasai Mara Wildlife Conservancies Association (MMWCA)
- Roll out awareness and education programme on importance of wildlife corridors.

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Annex

Pictorial presentation of the survey work

Plate 1: Survey team debrief and deployment in readiness to map the corridors

Plate 2: Mapping erected fences within the identified wildlife corridors

Plate 3: Fence damages by elephants and giraffes enclosed in an electric fence

Plate 4: Electrocuted bird and elephant dung along the identified corridors

Plate 5: Presence of water resources and heavy browsing of vegetation by elephants

LIST OF THE SURVEY TEAM

#	Officer Name	Position	Role
1	Stephen Akoto	Vi Agroforestry	Sema Project Coordinator
2	Dickson Ritan	Senior Warden	Head - Logistics
3	Joseph Edebe	Snr Research Scientist	Logistics/Team leader
4	Augustine Ajuoga	Deputy Warden	KWS - Project Coordinator
5	Stephen Mwiu	Research Scientist	Survey Team leader
6	Risper Asembo	Vi Agroforestry	Enumerator
7	Vasco Nyaga	Asst. Research Scientist	Enumerator
8	Grace Waiguchu	GIS Expert	Mapping/Enumerator
9	Faith Muchiri	GIS Expert	Mapping/Enumerator
10	Timothy M. Ikime	Asst. Research Scientist	Enumerator
11	Fidelma Makena	Asst. Research Scientist	Enumerator
12	Shillah Tumanka	Research Assistant	Enumerator
13	Josphine Tanui	Research Assistant	Enumerator
14	Shamil Karaiya	Research Assistant	Enumerator
15	Gilbert Kibet	Research Assistant	Enumerator
16	Joan Auma	Research Assistant	Enumerator
17	Mary Mwangi	Research Assistant	Enumerator
18	Edward Rinka	Research Assistant	Enumerator
19	Patrick Wachira	Ranger	Security
20	Ramadhan Leshore	Ranger	Security
21	Philip K. Ngeny	Driver	Logistics
22	Timothy Mulandi	Driver	Logistics
23	Simon Kones	Driver	Logistics

Notes

Notes

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