Elephant use and conflict leads to Tanzania's first wildlife conservation corridor

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Abstract

Corridors linking protected areas are recommended for reducing the effects of human settlements that fragment African elephant (*Loxodonta africana*) home ranges and dispersal areas, and increase human-elephant conflicts. Community interviews and hilltop surveys were used in two Maasai villages in northern Tanzania in 2000 and 2001 to determine the extent of wildlife conflict, community attitudes towards elephants, and if elephants were using a vegetation corridor between the two villages to move between Tanzania and southern Kenya. Elephants were the most problematic species in the two villages adjacent to the corridor due to crop-raiding of primarily maize (*Zea mays*) and beans (*Phaseolus vulgaris*). Although villagers considered elephants a nuisance, they believed they attracted tourists, and generally did not believe elephant numbers should be reduced. Elephants used the corridor primarily in the wet and early dry seasons, and breeding herds were more numerous than bull herds. Based upon elephant conflict and use, and the communities' need to maintain areas for cattle grazing and medicinal plant collection, the two Maasai communities established the first wildlife conservation corridor in Tanzania working in co-operation with government authorities and other stakeholders.

Key words: Amboseli, community interviews, crop-raiding, hilltop surveys, human-elephant conflict, Kilimanjaro, transboundary movements

Résumé

Les corridors reliant les aires protégées sont recommandés pour réduire les effets des peuplements humains qui fragmentent le domaine vital et les zones de dispersion de l'éléphant d'Afrique (*Loxodonta africana*), et augmentent les conflits hommes-éléphants. On a utilisé des interviews dans les communautés et des études à partir des collines chez les Maasai habitant deux villages au nord de la Tanzanie en 2000 et 2001 pour déterminer l'étendue des conflits avec la faune sauvage, les attitudes des communautés envers les éléphants, et si les éléphants utilisaient un corridor de végétation entre les deux villages pour se déplacer entre la Tanzanie et le sud du Kenya. Les éléphants étaient l'espèce la plus problématique dans les deux villages adjacents au corridor à cause de la maraude des cultures, surtout de maïs (*Zea mays*) et de haricots (*Phaseolus vulgaris*). Bien que les villageois considèrent les éléphants comme une nuisance, ils croient qu'ils attirent les touristes, et en général ils ne croient pas que le nombre d'éléphants devrait être réduit. Les éléphants utilisaient le corridor principalement pendant la saison des pluies et au début de la saison sèche, et les troupeaux familiaux étaient plus nombreux que ceux des mâles. En se basant sur les conflits avec les éléphants et la nécessité des communautés

de conserver les zones de pâturage et de collecte de plantes médicinales, les deux communautés Maasai ont créé le premier corridor pour la conservation de la faune en Tanzanie en collaboration avec les autorités gouvernementales et d'autres intervenants.

Introduction

With nearly 70% of the African elephant range outside of protected areas (Blanc et al. 2007) and increasing human settlements in many of these unprotected areas (Newmark 2008), elephant home ranges and dispersal areas are increasingly fragmented and human-elephant conflicts increasing (Barnes et al. 1997; Dublin et al. 1997; Hoare and du Toit 1999; Sitati et al. 2003; Lee and Graham 2006; Cushman et al. 2010). Movement corridors were recommended for linking protected areas and reducing human-elephant conflicts in Zimbabwe (Osborn and Parker 2003), Kenya (Douglas-Hamilton et al. 2005) and Tanzania (Mwalyosi 1991; Hofer et al. 2004), and as an option for reducing elephant densities in over-abundant elephant populations (Balfour et al. 2007; van Aarde and Jackson 2007). Further, human settlements and farms around many protected areas in Tanzania increase their isolation and pose barriers to traditional wildlife migration routes (Borner 1985; Mwalyosi 1991; Newmark 1993, 1996, 2008; Kamenya 2000; Hofer et al. 2004; Caro et al. 2009). Although some efforts are underway to establish conservation corridors in Tanzania, such as the Selous-Niassa (Hofer et al. 2004), Kwakuchinja (Gamassa 1987) and Derema (Ministry of Natural Resources and Tourism 2006; Newmark 2008) corridors and review by Caro et al. (2009), no conservation corridors were permanently protected by the Tanzanian national government until the current project.

Afolayan (1975) and later Grimshaw and Foley (1990) and Newmark (1993) suggested that elephants may be using a vegetation corridor (Kitendeni) to move between Mt Kilimanjaro and the Amboseli Plains in southern Kenya; however, the occurrence of this corridor was based upon aerial photos of elephant trails, ground observations of elephant sign (tracks and droppings) or discussions with local Maasai. Thus, the objectives of this study were to determine if this elephant movement corridor existed, the extent of its use by elephants and to assess the extent of wildlife conflicts and human attitudes towards elephants in two nearby Maasai communities. Lastly, we describe the process of working with the communities, government authorities and other stakeholders for establishing the first wildlife conservation corridor in Tanzania. We hope that this manuscript provides tools for establishing additional wildlife conservation corridors in Tanzania, as urged by Caro et al. (2009), and other African elephant range States.

Study area

The study area is in the West Kilimanjaro (West Kili) region of northern Tanzania, which is a complex mosaic of diverse natural communities, extensive grazing lands, large agricultural fields at lower elevations on Mt. Kilimanjaro, and diverse human populations, including agro-pastoral Maasai communities. The unprotected lands in West Kili may support as many as 600 elephants in the dry season (KERP 2003). The study area (3059 ha) for the hilltop surveys was a 6-km-wide corridor of vegetation off the northwest corner of Kilimanjaro National Park (NP) (formerly Forest Reserve) (Fig. 1). The corridor extends from the forest border of Kilimanjaro NP north to the Tanzania-Kenya border (6.6 km along the midline). Amboseli National Park is 15.5 km to the north of the international border.

The corridor was located within two Maasai villages, Kitendeni (2° 50' 53.50" S, 37° 14' 38.43" E) to the west and Irkaswa (2° 51' 52.65" S, 37° 19' 26.75" E) to the east. A ridge along the midline of the corridor delineates the boundary of the two villages. Two intermittent streams occur in the corridor; Olkeju-Loorgum stream defines the eastern edge of the corridor and the somewhat larger Kitendeni stream runs along the western edge of the corridor. During the study, numerous bomas (n≈20) were immediately adjacent to the corridor along about half the length of the eastern border in Irkaswa Village. On the Kitendeni side, there were five bomas and a school within the corridor and another 12 bomas outside the corridor (<1 km). One artificial water point stands within the corridor on the Kitendeni side. Two hills are adjacent to the corridor; these hills were used as observation points for our hilltop surveys. Kitashu Hill (1754 m) was about 800 m west of the western corridor boundary, and Kilima Nyuki (1750 m) was about 750 m from the eastern border of the corridor

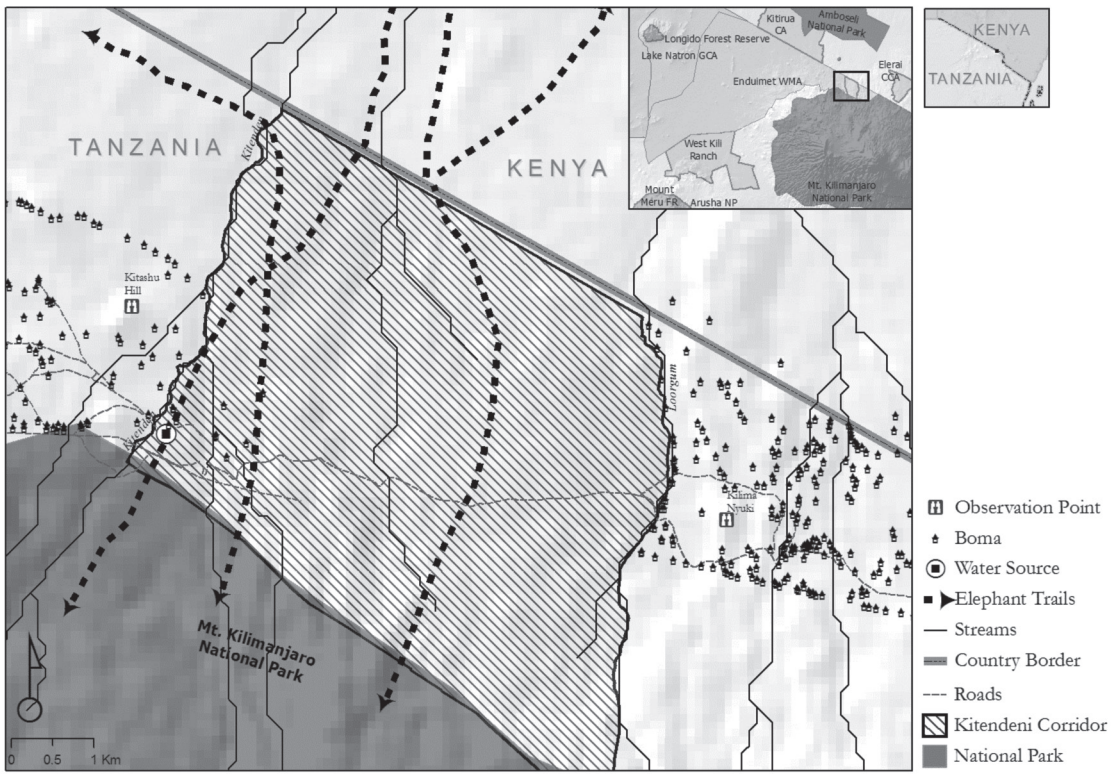

Figure 1. Kitendeni Corridor study area showing observation hills, physical and cultural features, and designated corridor boundaries (courtesy of African Wildlife Foundation, Nairobi, Kenya).

on the Irkaswa side.

The corridor extended from about 1600 to 1750 m elevation with a savannah climate with 220 cm annual rainfall (Rohr and Killingtveit 2003). Vegetation varies according to elevation with *Acacia seyal*, *A. nilotica*, *A. drepanolobium* and *Balanite aegyptiaca* dominate the woodlands at the upper portion of the corridor. *A. nubica* and *Commiphora africana* dominate the shrub communities in the lower portion of the corridor. Several large pockets of grassland (dominated by *Themeda triandra*, *Cynodon plectostachyus*, *C. dactylon* and *Pennisetum stramineum* also occurred on the eastern side of the upper portion and throughout the lower portion of the corridor. *Lantana* spp. shrubs occurred throughout the corridor in open areas.

Both Kitendeni and Irkaswa are agro-pastoral communities that graze cattle and other livestock and raise subsistence crops, primarily maize, beans, wheat (*Triticum aestivum*) and potatoes (*Solanum tuberosum*). Kitendeni was a small (78 households) traditional Maasai village, whereas Irkaswa was a larger village (501 households) (Monduli District Council, unpubl.) consisting mostly of Maasai (n≈70%) and other tribes (Waarusha and Chaga) and served as a market centre for three surrounding villages. Each village had a village council consisting of an elected village chairman, a village executive officer appointed by the Monduli District Council, and 25 community members elected to the council.

Methods

Community interviews

Interviews were conducted in October and November 2000 in the two villages adjacent to the corridor, Kitendeni and Irkaswa. In Kitendeni, three distinct groups were interviewed, the village chairman and executive officer, and a village women's group and a village men's group not on the council. In Irkaswa, two groups were interviewed, the village chairman and executive officer, and a combined group of village men and women who were not on the council.

After explaining the purpose of the interview to various groups, each group member was individually interviewed. Following Maasai custom, a woman interviewed the women in Kitendeni, whereas a man conducted the individual interviews for all other group members. Each interviewee was asked a series of questions about their background, wildlife conflicts in their village and attitudes towards elephants (Table 1). All interview questions were asked in Kiswahili, translated into Maasai, and responses again translated back into Kiswahili for recording. Individual interviews lasted 20–60 minutes. Responses to the background questions (Table 1, section A) were not used in the analyses because of small sample sizes.

Hilltop surveys

From December 2000 to May 2001, systematic observations were made simultaneously from the Kitashu and Kilima Nyuki hilltops by six observers who recorded numbers of elephants within the corridor during a 7-hour period (0730 to 1230 hrs and 1500 to 1700 hrs) for 3–5 continuous days per month. Observations stopped during observation periods when moderate to heavy rain and fog limited visibility. Using 12 x 50 mm binoculars, the hilltop vantage points provided observers complete views of the corridor from the forest border at Kilimanjaro NP north to the international border, and extending across the corridor to the ridgeline. We reduced the potential for multiple counts of the same herd during a day's observation period by having simultaneous observations from each hilltop, and subsequently comparing times of herd observations, herd size and unique ear and tusk characteristics of individuals within each herd. Further, the ridge running along the midline of the corridor also prevented observers from seeing across the entire width of the corridor, thereby reducing the potential for duplicate herd counts. Vegetation within the corridor limited our ability to determine herd structure consistently, especially the young elephants. Further, we could not always distinguish between individual herds during the monthly 3–5 day observation periods. Thus, we used the maximum count of elephants recorded during a single observation day for each month.

Table 1. Questions for respondent background, wildlife conflict, and attitudes about elephants used in interviews in Kitendeni and Irkaswa villages in northern Tanzania, October/November 2000

A. Background of respondent
   1. How many people in your household
   2. Age of respondent
   3. Sex of respondent
   4. Education? Primary/secondary/college
   5. Occupation?
   6. How long have you lived in this village?

B. Wildlife conflicts
   1. What are the problem wildlife species in your village?
   2. What problems do they cause?
   3. What crops do elephants raid?
   4. Why are the elephants here?
   5. Where do the elephant's come from?

C. Attitudes about elephants
   1. To what degree do you agree or disagree with the following statements:
      (strongly agree, agree, no opinion, disagree, strongly disagree)
      a. Elephants are a nuisance and should be kept away
      b. Elephants are a nuisance but they attract tourists
      c. Elephants should be left to roam free
      d. There are two many elephants
      e. Elephants should be killed to reduce the numbers

Results

Community interviews

We interviewed 15 people in Kitendeni (11 men, 4 women) and 20 in Irkaswa (15 men, 5 women). Although six species were identified as problem wildlife in the two villages—bush pig (*Potamochoerus larvatus*) (n=2 respondents), bushbuck (*Tragelaphus scriptus*) (n=1), southern eland (*Tragelaphus oryx*) (n=1), African buffalo (*Syncerus caffer*) (n=1), elephant (n=25), spotted hyena (*Crocuta crocuta*) (n=1)—respondents considered elephants the major problem wildlife species. Crop-raiding was the most frequent conflict caused by wildlife cited by respondents (n=29), while one respondent cited goat predation. Maize was the most frequently raided crop by elephants (n=21) with beans

(n=8), wheat (n=1) and potatoes (n=1) raided less frequently. Seventeen of the respondents in the two villages indicated that elephants primarily occurred near their villages from November–July. Respondents indicated that elephants used the area as a corridor (n=12), feeding area (n=11), because food (n=6) and water (n=2) were available, or to escape ants and tsetse flies (n=4). All respondents believed that elephants in their villages were coming from Amboseli NP (n=19) or Kilimanjaro NP (n=15), except one respondent who didn't know.

All respondents from Kitendeni (15/15) and 19 of 20 from Irkaswa disagreed with the statement that 'elephants are a nuisance and should be kept away'. For Kitendeni, 14 of the 15 respondents agreed/strongly agreed with the statement that 'elephants are a nuisance but attract tourists', and one respondent strongly disagreed with this statement. Similarly, 16 of the 20 respondents in Irkaswa strongly agreed/agreed with this statement, while four disagreed/strongly disagreed. All but one respondent from the two villages disagreed/strongly disagreed with the statement that 'elephants should be left to roam free'. Most of the respondents in both villages disagreed/strongly disagreed with the statement that 'there are two many elephants', and three agreed with that statement in Irkaswa and two stated 'they don't know'. All of the respondents in both villages disagreed/strongly disagreed with the statement that 'elephants should be killed to reduce the numbers'.

Hilltop surveys

Thirty-nine elephant herd observations (n=29 breeding, n=10 bull) occurred within the corridor during 24 observation days for the 6-month observation period, but there was much variation in numbers of elephants observed on a single day, ranging from 3 to 55. Both breeding and bull herds occurred in the corridor from December to May, but bull herds predominated in mid May at the beginning of dry season. Maximum daily number of elephants (n=55) occurred in March, and the lowest in December (n=20) and May (n=23) (Table 2). Based upon maximum daily number observed per month, typically more elephants were observed from Kitashu (=21.5, SD=3.4, n=6) than the Kilima Nyuki (=12.5, SD=10.9, n=6) hilltop for the 6-month observation period, but this difference was not significant (t=1.93, df=6, P=0.102).

Table 2. Maximum daily number of elephants observed per month from two hilltops within the Kitendeni Corridor in northern Tanzania from December 2000 - May 2001

Month (n=obs. days)	Kitashu	Kilima Nyuki
December (5)	18	2
January (4)	26	4
February (4)	22	19
March (3)	25	30
April (3)	20	15
May (5)	18	5

Discussion

Crop-raiding by elephants was the most serious wildlife problem for the two villages—most likely because of the close proximity of the corridor to the villages and its high use by elephants as reported during interviews. Maize was the crop most frequently raided by elephants because it is the most extensively grown crop in the two villages, similar to other human-elephant conflict studies in southern Kenya (Sitati et al. 2003) and southern Tanzania (Malima et al. 2005).

Despite the extensive problems that elephants had caused in villages, respondents did not believe that elephants should be kept away; however, they did not want elephants to roam freely in their villages. This positive attitude towards elephants may be related to the perception of respondents that elephants bring tourists to their villages. Although there is no evidence to indicate that these two villages directly benefited from tourism, community conservation programmes sponsored by Tanzania National Parks in both communities may have influenced their attitudes linking elephants and tourism. Further, we believe that reports of monetary benefits of wildlife and tourism in another nearby Maasai community (Sinya Mine) may have influenced this attitude. In contrast to the problems that elephants caused in both communities, most of the respondents did not believe that there were too many elephants, and none of the respondents wanted elephants killed to reduce their numbers.

Our hilltop surveys and interviews confirmed that elephants extensively utilized the corridor between the two villages, especially during the wet season, and respondents believed that the elephants in the corridor came from Amboseli or Kilimanjaro NPs. Although our hilltop surveys were conducted primarily in the wet season, respondents in the interview confirmed that elephants occur within the corridor during the wet season and part of the dry season. We believe that clay soil conditions in the lowlands of southern Kenya may discourage elephants from using these lowland areas during the wet season. Thus, elephants move up into the corridor where soils are better drained, and there is extensive scrub and woodland vegetation, providing abundant forage and cover from human disturbance. Further, human disturbance within the corridor is reduced during the wet season when the Maasai move their herds further west out of the corridor into open woodlands where grass is more abundant. Typically, Maasai herds return to the corridor during the dry season when grass diminishes in lowland plains and woodlands. Although vegetation is still available for elephants to browse during the dry season, water in the two streams is typically limited to small pools by mid-May; thus elephants begin moving out of the corridor. They move into the lowland plains and woodlands to the west where there are seasonal pans with water and north into Amboseli NP where there are permanent swamps with water. Elephants may use the corridor beyond July, but may be less noticed because of their lower numbers and absence of crop-raiding; all crops are harvested by this time.

The occurrence of more herds on the Kitendeni side of the corridor was likely due to several factors. First, the only permanent water available within the corridor was the artificial water point on the western side of the corridor (Fig. 1). This water point provided a reliable water source for elephants, especially during the dry season when there was no water in the two intermittent streams in the corridor. Further, the larger Kitendeni stream forms the western border of the corridor and water persisted longer into the dry season than for the smaller Olkeju-Loorgum stream along the eastern border of the corridor. The occurrence of two traditional elephant trails, one from Sinya Mine and the other from southern Kenya, converged on the west side of the corridor about 1.5 km south of the Kenya-Tanzania border (Fig. 1). This trail continues up the western side of the corridor to the artificial water point, extending to the forests of Kilimanjaro NP. Levels of human disturbance were probably higher on the eastern side of the corridor. Numerous bomas (n≈20) were immediately adjacent to the eastern corridor boundary in Irkaswa Village. In contrast, only five scattered bomas and a school occurred within the western side of the corridor in Kitendeni Village. Additionally, the corridor was primarily the only place where the Maasai from Irkaswa had access to graze their cattle. However, in addition to the corridor, the Kitendeni Maasai had access to the open woodlands and grasslands to the west of their village away from the corridor to graze their cattle. Thus, their use of the corridor for grazing was reduced, thereby decreasing the potential for disturbance of elephants within the western portion of the corridor. A subsequent satellite telemetry study (Kikoti 2009) of an adult female elephant collared in the Kitendeni Corridor supports the elephant movement observations of our hilltop surveys (Fig. 2).

Threats to the corridor

In 1989, the vegetation corridor extended for about 10 km west of Irkaswa Village when Grimshaw and Foley (1990) first visited the area. By the beginning of our study in 2000, the corridor was only 6 km wide. In this intervening decade, Irkaswa Village had expanded westward and numerous bomas and agricultural fields occurred within the eastern 4-km portion of the original 10 km-wide corridor. On the western Kitendeni side, a school and five bomas were established within the corridor. Further, in early 2001 after our hilltop surveys began, many people from Irkaswa Village (possibly as many as 200) began to mark trees, claiming plots of land within the corridor for future agricultural fields. These expanding human settlements into the corridor threatened the integrity of the remaining 6-km-wide vegetation corridor for cattle grazing and wildlife, and would result in increased human-wildlife conflicts and disturbance of wildlife. These increasing threats to the corridor were the impetus for us to initiate protective measures for the corridor.

Establishing the Kitendeni Corridor

Establishing the Kitendeni Corridor was a multi-step process over a 1.5-year period involving local communities, government authorities and other stakeholders. Our first step was to meet with the Enduimet Division Officer to discuss the threats facing the corridor and to obtain his support and assistance in working with the two villages that owned the corridor. He arranged meetings with the chairman and

executive officers of each village.

At each meeting typically only a few (often the most influential) of the participants would arrive at that time, and participants would continue to arrive over a three-hour period, and general conversations occurred before the formal meeting began. These informal conversations with participants were critically important because 1) they helped us to identify the most influential participants and many of the key issues that would arise later in the formal meeting; 2) 'got to know' people so that they were more likely to express their views in front of a 'stranger' during the formal meeting later; and 3) reduced misconceptions and reassure participants' concerns that their 'land would not be taken away' or 'the government would limit the use of their land'.

During the first meeting in each community, village leaders were asked about the importance of the corridor to the community and threats to the area. There were upwards of 400 people at one of the early meetings. Having food available at the end of every meeting encouraged people to attend and stay at meetings until the end. Another important meeting strategy was to have separate question and answer segments so that committee members could be better assisted in responding to concerns posed during the question segment. This process was critically important to avoid the perception that this was a meeting controlled by an 'outsider' not the village authorities.

The village leadership in each of the communities recognized that expansion of bomas and agricultural fields, as well as burning and tree-cutting, were threats to their cattle-grazing activities and to wildlife use of the area. With these threats acknowledge by the village leadership, additional village meetings were called to discuss the issue. At the village meetings, the people of Kitendeni recognized the importance of the corridor for cattle-grazing, wildlife and medicinal plants and the threats of human settlement; they wanted to find permanent solutions to these threats. Similarly, most of the community members in Irkaswa recognized the importance of the area and the threats to it, but several community members (n≈15 people) argued that the village had no room to expand and

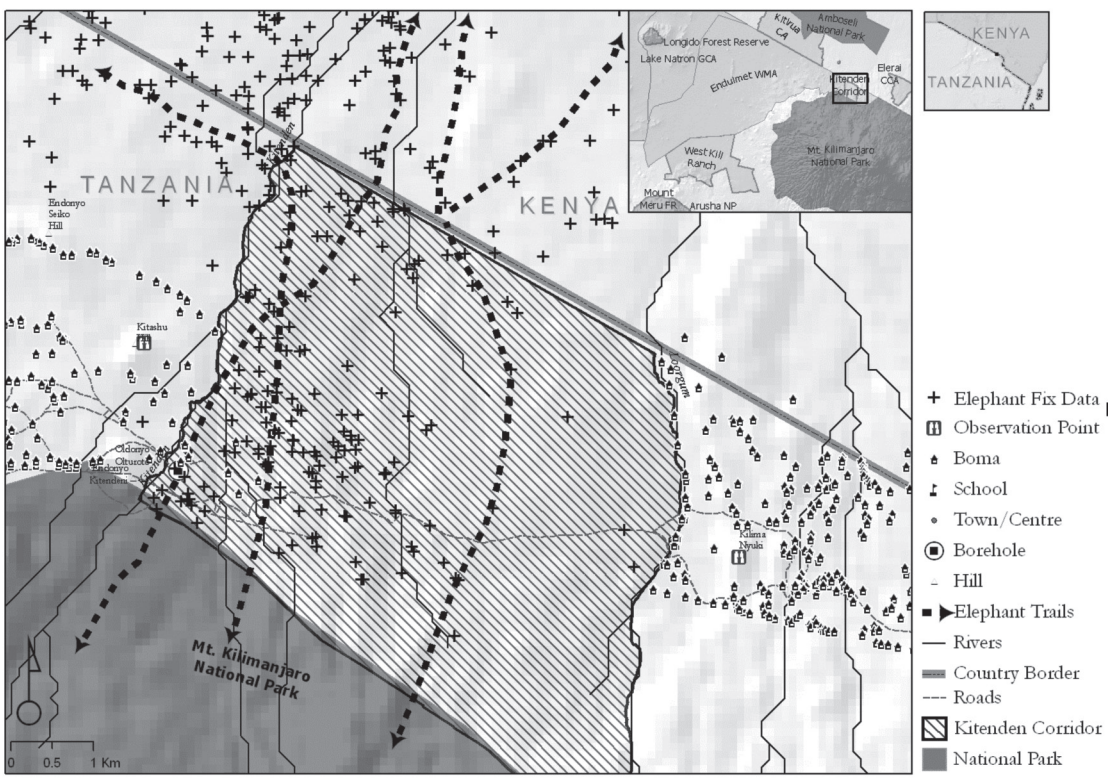

Figure 2. Locations of a satellite-collared adult female elephant in Kitendeni Corridor and southern Kenya from 6 November 2006 to 1 July 2008 (Kikoti 2009).

this area was needed for settlement and agriculture.

To build stronger consensus in the Irkaswa community for protecting the corridor, the Kitendeni Village leadership agreed to attend a village meeting in Irkaswa to discuss why they believed it was important to protect the area. This meeting served to reduce the number of people who opposed protecting the area, and in the end about five people out of the community of over 500 households still opposed protective measures. However, the Irkaswa community decided to continue with efforts to protect the area despite this small opposition.

Another critical element that played a pivotal role in building community support for the corridor began when we first initiated the research project, almost a year and a half before the first village meetings on the corridor. Without a strong, trusting relationship with the village elders developed over these early years, it would have been impossible to obtain the support and approval of the local communities to protect the corridor.

Once both communities agreed with the need to protect the corridor, a task force committee was formed, consisting of five representatives from each village, the division officer, the district game officer and the field researcher (A. Kikoti). This task force created a report that documented the threats to the corridor and recommended designation of a 5 km-wide corridor (2881 ha) and what activities should be permitted within it—including livestock grazing, medicinal plant collection and firewood collection of dead wood only. Villagers collecting honey would be required to obtain a permit, which was done in an effort to reduce the incidence of wildfires that can result from untended fires used during honey collection. No settlement would be allowed, including temporary bomas. The task force also recommended that five bomas in the corridor and the Kitendeni School be relocated. Although the school was not within the proposed 5 km-wide corridor, it was located 600 m west of the proposed corridor border and 70 m south of the artificial water point. This proximity to the corridor and the water point that is used extensively by elephants posed a great risk to the students and staff.

The draft corridor management plan was presented as a workshop, one in each community. Following minor revisions, the plan was submitted to the Ward Development Committee. Although several members of the task force also served on the Ward Development Committee, many other stakeholders were on the committee, including village and natural resource authorities, the head teacher from the Kitendeni School, private landowners, representatives from tour operators and non-governmental organizations. After minor revisions, the committee approved the plan and forwarded the plan to the Monduli District Council.

The district council sent their technical staff into the field to confirm the details of the report; for example, they verified that there was support for the plan in the two villages. They also requested assistance from the villages to survey and demarcate the corridor. The boundaries of the corridor were surveyed and a map prepared for district council review. Upon approval by the district council, the mapped boundaries were confirmed again at village meetings, after which the district council installed survey beacons along the boundaries of the corridor. A final district council report was developed justifying the establishment of the corridor and documenting the survey points, and sent to the National Land Commission for final approval.

The commission then sent a technical team to verify the report received from the district council to confirm the boundaries and reconfirm that villagers were aware of the corridor designation. Although the proposal had been submitted to the land commission as the Kitendeni Wildlife Corridor, there was no provision under the Wildlife Act of Tanzania of 1974 to establish a 'wildlife corridor'. Thus, in October 2002, the corridor was registered by the land commission as a 'farm' where the only allowable activities were defined by the corridor management plan developed by the task force and accepted by the communities.

Following designation by the land commission, people living in the five bomas within the corridor were given land elsewhere within the village and time to establish their new bomas. The Tanzania National Parks, Monduli District Council and other stakeholders provided funds to build and furnish a new school away from the corridor. After these relocations, the corridor was expanded by an additional 178 ha to include the area around the artificial water point and former school. Since its designation in 2002, local game scouts from the villages regularly patrol the corridor for unauthorized activities. This monitoring and strong resolve of both communities to enforce the provisions of their corridor management plan are critical for protecting the integrity of Tanzania's first wildlife conservation corridor.

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