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Evaluating the effectiveness of community-based conservation in northern Kenya

A Report to The Nature Conservancy

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Executive Summary

Poverty alleviation and biodiversity conservation are some of the most serious challenges currently facing civil society. Increasingly, these issues have been seen as linked, both in international declarations such as the Millennium Development Goals and at the individual project level. However, there is little understanding about how it may be used to provide simultaneous benefits for communities and biodiversity in developing nations due to a lack of evidence.

This study reports ecological and socioeconomic outcomes of a community-based conservation project in the arid rangelands of northern Kenya, which links biodiversity conservation with local livelihoods. The Northern Rangelands Trust (NRT) provides technical support to 17 conservancies managed by the pastoralist communities. NRT's impact was assessed in three conservancies, Namunyak Wildlife Conservation Trust, Sera Wildlife Conservancy and West Gate Community Conservancy. Conservancies were compared to non-conserved baselines with similar socioeconomic and environmental conditions, identified using maximum entropy modelling.

In a sample of more than 600 households, NRT and its constituent conservancies were found to enhance livelihoods in participating communities, compared to baseline conditions. In Namunyak and West Gate, community conservation has led to significant positive change in livelihoods for communities engaged in the initiative.

Benefits occur at both the household and community level and are typically not financial in nature. Increasing physical security and access to affordable transport were the most important impacts for households. Some direct financial impacts have occurred through the provision of educational and medical scholarships and to a lesser extent through paid employment. Incomes in conservancy communities were significantly more likely to be described as 'stable or increasing' than in non-conservancy areas, and small-scale changes in the activities used to generate income are apparent.

Three types of impacts were seen to occur as a result of NRT. The first were complementary to changes occurring across in the region, with community institutions taking over the role of development NGOs or local government. For example, West Gate Community Conservancy provides water to the community at Ngutuk Ongiron. The second were additional benefits, such the disbursement of bursaries to fund secondary and higher education which would not have occurred without conservancy establishment. Finally, conservancies acted to stabilise certain livelihoods components, such as access to firewood, buffering participating communities from resource shocks seen in other communities in the region.

Remotely-sensed imagery was used to evaluate the ecological impact of community conservation initiatives in the region. A tasselled cap transformation was performed on both dry season and rainy season imagery, and the differences analysed. Green vegetation increased significantly between 2000 and 2007 in community conserved areas, when compared to baseline sites. From the pattern of change in pixel brightness and moisture suggests leaf litter has also significantly increased in NRT areas. Greater green and senescent vegetation cover is indicative improved habitat condition in community conserved areas. Grazing was an important determinant of vegetation change within the management zones of conservancies. Seasonally-grazed buffer zones experienced significantly higher increases in green vegetation during the dry season, than the 'no-take' core zones due to stimulatory effects of grazing and livestock presence on photosynthetic activity.

The establishment of conservancies in northern Kenya has led to positive outcomes for both communities and the environment in which they live. Conservation has enhanced livelihoods by facilitating community access to public services and infrastructure. These socioeconomic changes have occurred in the context of significant improvements to habitat condition driven by sustainable grazing management.

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1. Introduction

1.1. Poverty alleviation and the conservation of biodiversity

The alleviation of human poverty and biodiversity conservation are two of the most serious and intractable global issues facing civil society. In 2009, 27% of the global population was described as living in chronic poverty and 26% of the world's children under the age of five were malnourished (United Nations, 2010). In sub-Saharan Africa, approximately a quarter of primary-school-age children were not in school and over two-thirds of the population had no access to improved sanitation (United Nations, 2010). While poverty alleviation initiatives have made substantial progress, efforts continue to fall far short of that laid out in the United Nations' Millennium Development Goals (United Nations, 2010).

Concurrently, global biodiversity is undergoing rapid and substantial loss, with species and habitats in decline at an estimated 0.5% to 1% per year (Balmford & Cowling, 2006). In an attempt to curtail this loss, the international community spends an estimated $6-10 billion per year on the maintenance of biological resources (James et al., 2001; Molnar et al., 2004; Gutman & Davidson, 2007; Pearce, 2007), the majority is used to maintain a global protected area network (James et al., 2001). Despite some localised successes, it is clear that the threats to biodiversity remain largely undiminished (Salafsky et al., 2001; Kiss, 2004; Sutherland et al., 2004; Stewart et al., 2005).

In the search for a solution, the international community has sought a 'silver-bullet' which could simultaneously alleviate human poverty and curb biodiversity loss, based on an assumed relationship between the two issues.

1.2 Linkages between poverty and conservation

The need to promote poverty alleviation efforts has become an increasingly common theme in the conservation sector. At the 7th Conference of Parties to the Convention on Biological Diversity held in 2002, participants agreed 'to achieve by 2010 a significant reduction in the current rate of biodiversity loss ...as a contribution to poverty alleviation and to the benefit of all life on Earth' (Convention on Biological Diversity, 2002). In 2003, the World Parks Congress went further, recommending that protected areas should 'make a full contribution to sustainable development' (IUCN, 2004) and 'at least do no harm' to people in their vicinity (IUCN, 2004). However, the inclusion of development goals in conservation and the assumed underlying linkage between these goals is far from universally accepted and is the focus of an increasingly acrimonious debate (for a discussion see: Roe, 2008).

Far from a simple 'win-win' relationship that international agreements implicitly assume exists, Adams et al. (2004) identified four policy positions, reflecting disparate and at times conflicting views on the poverty-conservation linkage:

1. 'Poverty and conservation are separate policy realms'
2. 'Poverty is a critical constraint on the conservation of biodiversity'
3. 'Biodiversity should not compromise poverty reduction'
4. 'Poverty reduction depends on biodiversity conservation'

Under these positions, conservation may exacerbate (e.g., McShane & Newby, 2004; Lockwood et al., 2006), underpin (Leisher et al., 2007), act as a 'safety net' (Dudley et al., 2008) or have little impact on poverty alleviation.

1.3 Community conservation: a silver bullet for conservation and development?

Despite the lack of clarity in the policy debate, the practice of linking conservation and development has a long history, particularly in sub-Saharan Africa.

Community conservation aims to provide an incentive for the sustainable management of biodiversity resources, by linking their maintenance with poverty alleviation or livelihoods benefits for the people living in their vicinity (Salafsky & Wollenberg, 2000). This has typically achieved through wildlife-linked enterprises, such as tourism or wild harvesting of resources (Hughes & Flintan, 2001). While it has formed a component of protected area outreach in some cases, community conservation is more commonly associated with land outside of the formal protected area network (Wells et al., 1992).

Community conservation emerged from the recognition that strictly protected areas often failed to consider the interests of local communities, reducing their willingness to support or abide by conservation regulations (Pimbert & Pretty, 1997; Kiss, 2004). Indeed, in some areas, strict protection resulted in active hostility between conservation authorities and local communities (Robbins et al., 2006). The need to engage communities in conservation was heightened by the realisation that biodiversity resources are both subject to, and depend upon processes and policies, which act at national and global scale (Ancrenaz et al., 2007). Consequently, an approach which can reconcile the needs of biodiversity conservation and economic development was seen a vital tool particularly in developing nations.

In the 1980s, community-based conservation, integrated conservation and development along with community-based natural resource management, rose to prominence as tools through which win-win outcomes for conservation and development were thought to be achievable (Hulme & Murphree, 1999; Hughes & Flintan, 2001; McShane & Wells, 2004). Across sub-Saharan Africa, these strategies with their

emphasis on participation and empowerment supplemented traditional 'fines-and-fences' conservation in the areas outside of the formal protected area network (see Roe et al., 2000 for examples). However, the anticipated win-win outcome proved elusive. In practice, results tended to be ambiguous, complex and locally-specific, even in the flagship 'CAMPFIRE' and 'ADMADE' programmes in southern Africa which were specifically designed to generate community benefit (Songorwa et al., 2000).

Reporting on an integrated conservation and development project in Cameroon, Abbot et al,2001) concluded that the inclusion of rural development initiatives promoting alternative livelihoods can improve the sustainability of conservation in an area by altering community attitudes and behaviours. However, even this relationship was not straightforward. While community participation in the livelihoods programme created a 'pre-disposition' among community members towards biodiversity conservation, it did not predict an individual's attitude or behaviour in relation to the conservation project (Abbot et al., 2001).

Elsewhere, Franks (2008) examined the socioeconomic complexities of conservation outcomes in developing nations. While the protected areas analysed had both costs and benefits, these accrue to different stakeholders and operate at different spatial scales (Franks, 2008). Benefits were typically found to occur at a global scale, through the provision of ecosystem services while costs to the global community were limited (Franks, 2008). At the local scale, direct financial benefit was relatively small and opportunity costs resulting from livelihoods restrictions higher (Franks, 2008). Within the local community at Bwindi Impenetrable National Park, Uganda, these costs were borne largely by the poorest in society and exceeded US$200 per household per year (Franks, 2008). The impact on wealthy community members was less negative, with costs less than US$150 per household per year. In parallel, the latter experienced greater benefit than their poorer community members (Franks, 2008). Similarly, Upton *et al.* (2008) reported an analysis of protected area network size and spatial configuration, which found conservation-poverty linkages to be 'dynamic and locally specific'. The authors concluded that while a win-win solution to biodiversity loss and poverty may be possible, it is likely to be rarer than situations where a trade-off between these goals is required (Upton et al., 2008). These findings were echoed in a global review by Coad et al. (2008) which highlighted the inequity in the spatial and demographic distribution of the costs and benefits of conservation. Consequently, it would appear that the relationship between poverty and conservation varies not only from place to place but person to person.

On a broader scale, the poverty-conservation linkage has been conceptualised as a relationship between the number, size and location of protected areas and the incidence of poverty, typically at the national scale. In an analysis covering 119 countries, de Sherbinin (2008) found little evidence for a relationship either positive or negative between poverty and protected areas. In Thailand and Costa

Rica, communities living close to protected areas are poorer than most in their respective nations but the impact of the protected areas in both countries was to alleviate poverty (Andam et al., 2010).

1.4 Examining the linkages between poverty alleviation and biodiversity conservation

Advancing the poverty-conservation debate has, however, proved difficult in the face of little quantitative evidence on which to support conclusions (Stewart et al., 2005). In line with the wider conservation sector, monitoring the impact of community-based approaches to the management of biological resources is rare; and despite many calls from conservationists over the past decade (Croze, 1982; Thorsell, 1982; Kremen et al., 1994; Pullin & Knight, 2001; Brooks et al., 2006; Sutherland et al., 2009), little progress has been made toward the inclusion of scientific monitoring as an essential element of conservation initiatives (Ferraro & Pattanayak, 2006). This led the authors of the 2005 Millennium Ecosystems Assessment to conclude that 'few well-designed empirical analyses assess even the most common biodiversity conservation measures' (Millenium Ecosystems Assessment, 2005: 122). Consequently, much of the current scientific thinking on the relationship between poverty and conservation is based on expert opinion rather than data from well-designed monitoring studies (Pullin et al., 2004).

Typically, impact monitoring in the conservation sector takes the form of a case-study narrative, in which the aims, implementation and outcomes of an initiative are described qualitatively (e.g Roe & Jack, 2001; Sikoyo et al., 2001). While such narratives have an important role to play in providing contextual detail, they do not allow for the statistical analysis and, importantly, the testing of hypotheses about the poverty-conservation linkage (Ravallion, 2007).

To demonstrate the impact of a conservation project in a statistically robust manner, one of two approaches must be adopted (Ravallion, 2007). The first is a before-after comparison in which conditions prior to the project are contrasted with those occurring during or after project implementation. However, this approach requires access to relevant pre-project data, which is seldom collected or available, particularly in developing nations. Furthermore, it can be confounded by concurrent events which affect the target variables during the period of project implementation. Such events could take the form of natural hazards, such as drought, or floods but may also be socioeconomic changes resulting from government policy or market forces (Ferraro & Pattanayak, 2006).

The second approach assesses the differences in conditions at the project site with those in an area where the project has not taken place, commonly called an 'inside-outside comparison'. This method has been used to monitor the impact of conservation initiatives on the threat posed by deforestation (Bruner et al., 2001; Oliveira et al., 2007), fire (Nepstad et al., 2006; Román-Cuesta & Martínez-Vilalta,

2006) and hunting (Laurance et al., 2006) as well as directly measuring target species' abundance (Caro, 1999; Kaunda-Arara & Rose, 2004; Nardi et al., 2004; Ogutu et al., 2005; Stoner et al., 2007) and habitat condition (Jansson et al., 2005).

The difficulty with this approach is the identification of suitable areas to compare project site conditions with. One commonly adopted approach is to compare a project with its immediate surroundings. A study examining the impact of conservation in the forests of Mexico highlights the problems inherent to this approach. Mas (2005) compared deforestation rates in the Calakmul Biosphere Reserve in Mexico with those in its immediate vicinity, concluding that Calakmul's establishment had reduced deforestation by 1% per year. However, when the Reserve was compared with an ecologically similar region, this impact reduced to 0.3% per year (Mas, 2005). Similar effects have been reported in Costa Rica (Andam et al., 2008) and Peru (Oliveira et al., 2007).

The problem arises because the impact of conservation is seldom confined to the project boundary, unless that boundary coincides with a substantial geographic barrier. Consequently, positive impacts may overspill the operational boundary, particularly in marine environments (McClanahan & Mangi, 2000). As seen in Mexico (Mas, 2005), the converse is also possible, with a conservation project reducing threats to biodiversity in its area of operation by displacing them to the surrounding area, an effect called 'leakage' (Ewers & Rodrigues, 2008).

The issues of spill-over and leakage, together termed 'interaction effects', mean that it necessary to compare conservation outcomes with conditions in similar but distinct areas. Such matched comparison methods are common in other types of evaluation such as education (e.g., Blundell et al., 2005) and health (e.g., Sheline et al., 2008) in which individuals participating in a programme are compared with similar non-participating individuals.

In the conservation sector, matched comparisons have been used to estimate the impact of protected areas on deforestation in Indonesia (Linkie et al., 2008) and Costa Rica (Andam et al., 2008) as well as to assess the contribution of marine protected areas in the Pacific to poverty reduction goals (Leisher et al., 2007). Matched comparison groups may be identified using both qualitative and quantitative techniques, with Leisher et al., (2007) identifying a comparison group using the knowledge of local experts while Linkie et al., (2008) and Andam et al., (2008) used statistical matching procedures. In this report, a novel approach which combines statistical matching with review by local experts was employed to assess the socioeconomic and ecological outcomes of a community-based conservation project in northern Kenya (Glew *et al.,* in preparation).

2. Community conservation in northern Kenya

2.1 The Northern Rangelands Trust

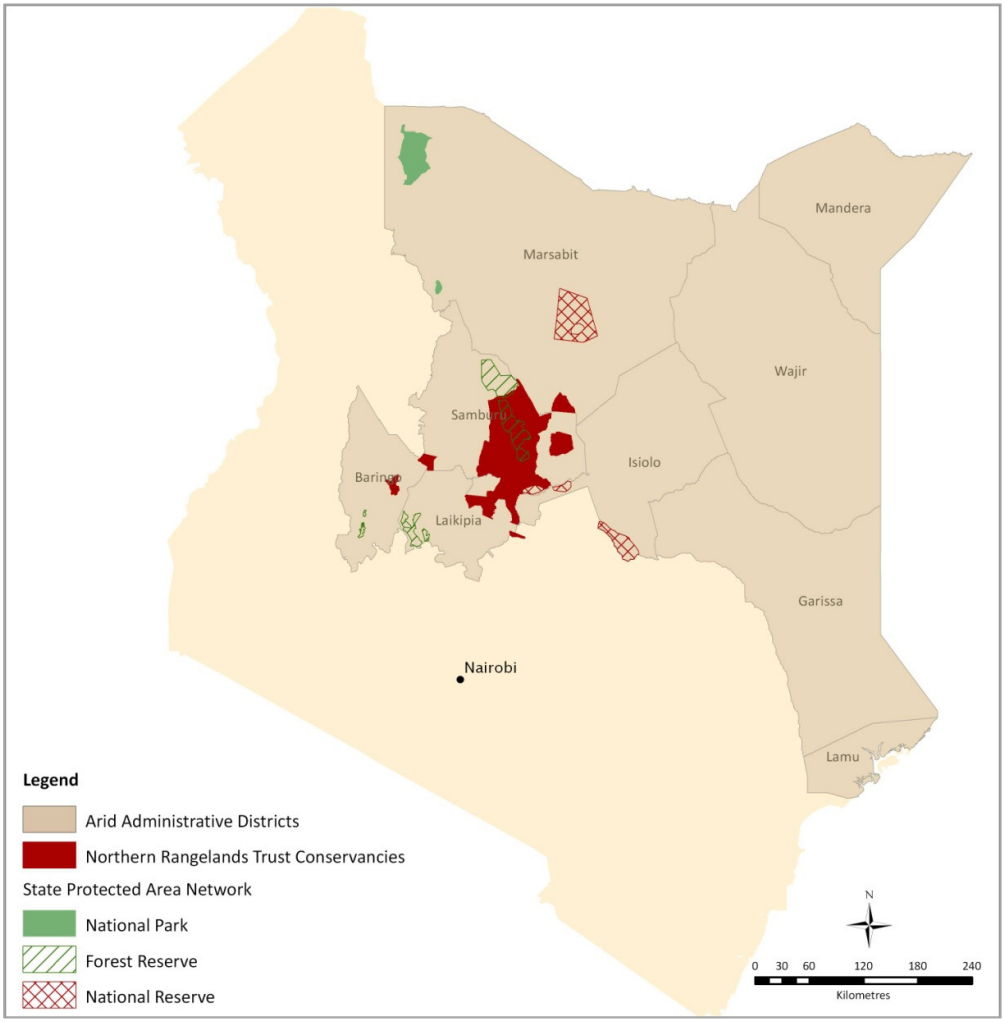
The Northern Rangelands Trust (NRT) is a community-based conservation initiative in the arid and semi-arid rangelands of northern Kenya which aims to '...improve the livelihoods of communities through wildlife conservation...' (NRT, 2008:3). Established in 2004, it has facilitated the formation of community-led institutions which link rangeland management and conservation of large mammal species with poverty alleviation for their constituent communities. Since 2004, the network of conservancies assisted by NRT has expanded rapidly and by 2009 had brought more than 8,300 km^2 of land outside of Kenya's formal protected area system under conservation management (Brown, 2009; Figure 1).

NRT has its origins in a partnership between local communities and Lewa Wildlife Conservancy (LWC), a privately owned ranch managed for biodiversity conservation since the 1980s. Initially an outreach programme from LWC which helped neighbouring communities establish Il Ng'wesi and Namunyak Wildlife Conservation Trust, the conservancies were developed as tool to mitigate human-wildlife conflict and enhance landscape-scale conservation in the region. With the rapid expansion of the conservancy network, it became apparent that an independent organisation was required to provide effective technical assistance and meet the knowledge demands of the increasing number of participating communities (Box 1).

NRT is comprised of community, institutional and private-sector members. Community members receive one of four levels of technical support ranging from technical advice and capacity building to enterprise development. Receipt of this support depends on conservancies undertaking a '...pro-active programme of improving the ecology within their respective areas' (NRT, 2007: 8) and undergoing independent financial audits. Where these conditions are not met, community members may have support suspended (NRT, 2007).

While the majority of NRT staff are Kenyan nationals resident in the conservancy communities, funding for the initiative is primarily derived from international donors, including USAID, Fauna and Flora International, St. Louis Zoo, and Zoos Victoria. Typically, NRT seeks to establish long-term partnerships between a donor and individual conservancies to provide sustained funding for community enterprises and conservation management.

Figure 1. The Northern Rangelands Trust conservancy network in the arid districts of northern Kenya



Sources: The Africover project, UNEP-WCMC and the Northern Rangelands Trust.

BOX 1. The formation of the Northern Rangelands Trust.

"*NRT evolved based on the success of Il Ng'wesi and Namunyak in terms of conservation, exposing us as conservationists to the window of opportunity that exists when you bring a community into a co-ordinated approach. So we saw what happened in Namunyak, we saw what happened in Il Ng'wesi, there was conservation success, there was commercial success. It brought elements of peace into a society where previously people had been killing each other. We realised that Lewa having supported those two projects in the first place was too much of a private sector animal to expand its community programme. It was just the wrong approach. you had a community model with a proven record of success; Lewa was too private sector driven to give community's the leadership role required and access to bi lateral donors, yet these conservancies couldn't work effectively unless they had the back-up and the long-term and resilient support in terms of logistics, finance, security, exposure to Government, exposure to donors, standards in terms of governance and fiscal responsibility and hence we needed a new organisation. We also realise* [sic.] *that there's a lot of donor money out there for conservation that is mis-spent or it doesn't have a clean, clear responsible window of entry into communities, where communities will have jurisdiction over such funds. So we required an organisation that was community-owned, community-driven, and that had access to professionalism in terms of expected standards from donors and our own Government. An organisation that could set the bar based on experience. So the Northern Rangelands Trust evolved as the umbrella-organisation and the conservancies evolved based on the success of those other two* [Il Ng'wesi and Namunyak]."

Ian Craig, Executive Director Northern Rangelands Trust.

2.2 Conservancy structure and programmes.

While individual conservancies differ, the NRT model operates on the basis of a zoned management system. Each conservancy consists of a core conservation area in which grazing by domestic livestock is strictly prohibited. In many cases, this area is relatively small, with core areas across the network averaging 35.1 (± SD 51.0) km^2. A larger buffer zone ($\bar{x}$ =132.9 ± SD 177.5 km^2) surrounds this core, which acts as a dry season grazing reserve for domestic stock. The remainder of conservancy lands are not managed for conservation per se, but an increasing number are seeking to adopt more sustainable management practices across their areas.

Grazing management and providing security for wildlife populations are the central tenets of biodiversity conservation in the NRT network, with additional programmes to deal with specific threats added on where necessary. The management of wildlife is linked to poverty alleviation initiatives through small-scale community-driven enterprise. To date, much of this enterprise has been tourism-

related, with six lodges now operational in the region, whose revenue is shared with the community or whose guests are subject to a bed-night and conservation-fee levied by the communities. In addition, programmes to manage livestock production more effectively and provide alternative livelihoods are run by NRT. The latter focuses on the marketing of locally produced handicrafts through NRT Trading and microfinance, which aims to provide local women with independent income as well as diversifying the household livelihood base (see www.nrt-kenya.org for further information on specific programmes).

Conservancy management is undertaken by local institutions, staffed by community members. Each consists of a core administrative team of manager, community manager and accountant together with a security team. Trustees, elected by the communities, represent individual villages or management units and form a Conservancy Board who determine strategic management activities. In addition, an elected grazing committee determines grazing access to the buffer zone and manages the grass resources of the community. In the majority of conservancies, an annual general meeting is held to provide feedback to the community and ensure management is accountable to the community.

2.3 Environmental context for community conservation in northern Kenya

The NRT conservancies extend north from the foothills of Mount Kenya, toward the frontier with Ethiopia and Somalia. To the west the region is bounded by the Great Rift Valley, and to the south by the Tana River. They occupy arid and semi-arid rangelands in which rainfall is low and unpredictable. Drought is a common occurrence, most recently occurring in 2009 when the failure of the March-May seasonal rains led to the most severe drought for 25 years (UNOCHA, 2009).

In Kenya, arid regions account for more than 80% of the land area, 60% of the livestock, and 25% of the nation's population (Kameri-Mbote, 2005). These arid lands are a mosaic of dry woodland, bushveld and savanna dominated by *Brachysteiga* and *Combretum* species. As rainfall declines, these are gradually succeeded by *Commiphora* and *Acacia* dominated assemblages. In the absence of permanent water, tree cover declines and gives way to grasslands and drought-tolerant shrubs (Agnew et al., 2000). The northern rangelands support diverse animal assemblages, including many species vulnerable to extinction. The area represents the core remaining habitat for the endangered Grevy's zebra (*Equus grevyi*), whose population has halved since 1988 due to habitat loss (Nelson & Williams, 2003; Moehlman et al., 2008). It is estimated that 95% of the remaining 2,500 Grevy zebra have their home ranges in northern Kenya.

Many conservation-dependent species present in northern Kenya have substantial home ranges or are migratory, including African Elephant (*Loxodonta africana*), African Hunting Dog (*Lycaon pictus*) and Grevy's Zebra (Nelson & Williams, 2003; Douglas-Hamilton et al., 2005; Woodroffe et al., 2005). As a

consequence, these species are dependent on areas outside of the Government's protected area system and require efforts to allow their persistence in human-dominated landscapes.

2.4 Socioeconomic context for community conservation in northern Kenya

The northern rangelands are the most underdeveloped and economically marginalised region of Kenya. At 0.67, the multidimensional poverty index (MPI) for this region is amongst the highest worldwide, exceeding the national average for Niger (0.64), the world's poorest nation under this measure (Alkire & Santos, 2010). Across the region, poverty is significantly higher than the national average (Alkire & Santos, 2010) and in some Districts more than half the population lives below the Kenyan poverty line (GoK, 2005). In Samburu District, just under half of all adults are illiterate, a third lack access to safe drinking water, and three-quarters lack access to a qualified doctor (Kumssa et al., 2009). The region lacks basic social and physical infrastructure, and development is limited by low literacy and the near-absence of paved roads (Lesorogol, 2008). Communities are highly reliant on livestock, and limited income diversity leaves many vulnerable to resource shocks, such as drought (Esilaba, 2005). Many households are dependent on government and NGO assistance programmes (Mwaniki et al., 2007), particularly during periods of resource scarcity. After the 2009 drought, 13% of Kenyans were in need of food aid and cholera had re-emerged in 12 districts (UNOCHA, 2009).

Pastoralism, the socioeconomic system based on rearing and herding livestock has been the dominant livelihood in the arid rangelands for at least 5,000 years (Swift et al., 1996). In northern Kenya, herds are primarily comprised of cattle (*Bos indicus*), goats (*Capra hircus*) as well as smaller herds of donkeys (*Equus asinus*) and camels (*Camelus dromedarius*).

The pastoralist community is diverse and inter-ethnic, with each group moving across relatively large areas in search of suitable pasture. Traditionally, access to the grazing resource was managed using a decentralised system, administered by tribal elders. Under this system, the elders could reserve areas as dry-season only grazing, regulate the use of water points, and provide a forum for non-local herders to temporarily negotiate access to a particular area (Spencer, 2004). However, colonial rule and post-independence policies undermined this traditional management system (Rutten, 1992; Lesorogol, 2008) and together with the provision of fixed infrastructure, reduced pastoralist mobility in the region (Niamir-Fuller & Turner, 1999; Boone, 2005).

The decline in traditional governance and wider insecurity in the Horn of Africa have combined to make low-cost illicit firearms readily available and a significant minority in the pastoralist community willing to use them to enforce their perceived resource access rights. Cattle raiding has become more frequent

with the increasing availability of illicit firearms. In Samburu District, 88% of respondents reported that they have used firearms in their possession in cattle raids (Pkalya et al., 2003), with comparable figures likely elsewhere in the region. Cattle raiding is estimated to result in the loss of US$1 million annually in Samburu District (Buchanan-Smith & Lind, 2005) and is a significant factor constraining economic development in the region (CDC et al., 2009).

3. Ecological outcomes of community conservation

The strategic ecological aims of NRT and its constituent conservancies focus on both habitat condition of the semi-arid rangelands and the species which utilise them. The implementation of appropriate management systems is seen as critical to improving rangeland condition and fostering 'well-managed, viable pasture management' as well as sustaining livestock production (NRT 2008:4).

3.1 Methodology

3.1.1 Site selection

Each conservancy was matched to three similar, but non-conserved sites in northern Kenya. These sites acted as a baseline against which the environmental and socioeconomic impact of community conservation could be measured. A statistical matching technique was used to identify suitable comparison sites for the study based on a range of environmental and social characteristics. Datasets for each of these variables (Table 3.1) from the period immediately prior to the establishment of the first community conservancies in northern Kenya in 1995 were combined in a Geographic Information System. Values were derived for each non-participating sub-location in northern Kenya and were matched to conservancies using maximum entropy modelling (Glew *et al.,* in preparation). Sites with the highest probability of similarity to each conservancy were sent to a panel of local experts. As a result of this review process sub-locations where the safety of researchers could not be assured or other programmes were known to be ongoing, were removed from the list of candidate sites. The final non-conserved baseline consisted of the three most similar matches for each conservancy, after the expert review process had taken place.

Table 3.1 Environmental and socioeconomic variables used to match Northern Rangelands Trust conservancies to non-participating sites in northern Kenya. Data depositories are given in brackets.

Environmental Variables	Socioeconomic variables
Mean annual temperature (WorldClim)	Population density (International Livestock Research Institute)
Iso-thermality (WorldClim)	Density of households living in chronic poverty (International Livestock Research Institute)
Wet season precipitation (WorldClim)	Socioeconomic inequality index (International Livestock Research Institute)
Wildlife density in 1990 (International Livestock Research Institute)	Livestock density in 1990 (International Livestock Research Institute)

3.1.2 Remote Sensing Methodology

A series of LandSat TM and ETM+ images were acquired from the United States Geological Service Global Visualisation Viewer (http://glovis.usgs.gov). Image selection was based on the availability of cloud-free scenes in the estimated 'maximum green' and 'minimum green' periods each year. Maximum green is the peak in vegetation biomass associated with a period of high rainfall, while the 'minimum green' occurs during the dry season when few plants remain in leaf.

Maximum and minimum green dates for each year were identified using modelled precipitation data. Daily rainfall estimates derived from the RFE 1.0 and 2.0 models (NOAA, 2002) were re-sampled into a ten-day 5km resolution time-series spanning 1st January 2000 to 31st December 2009. Year-on-year variation in the timing of the rains means that maximum and minimum green occur at different times each year. Consequently, it is necessary to use an objective definition to pin-point when these conditions occur. In the study region, the peak in vegetation greenness occurs on average 27 days after the start of the rains (Zhang et al., 2005). Minimum green was defined as the ten day period immediately prior to the rainy season. The onset of the rains was defined as the first ten-day period in which total rainfall exceeded 20mm, occurring in a thirty day window in which cumulative rainfall exceed 80mm (Zhang et al., 2005).

Cloud-free or partially cloud-free images closest to these dates were selected for analysis. Widespread cloud coverage in the 'maximum green' period which by definition occurs in the rainy season restricted analysis to imagery acquired by the sensor in 2000 and 2007.

Northern Kenya has two distinct rainy seasons each year, the March-May long rains and the short rains between September and November, meaning that maximum green should occur in mid-May and minimum green at the end of February (Swift et al., 1996). However, the timing and intensity of the rains fluctuates year-on-year and drought is frequent (Swift et al., 1996). In 2007, theoretical maximum green and minimum green occurred on 26th May and 20th February respectively. However, in 2000, the rains failed preventing the calculation of the theoretical date of maximum green. Consequently, maximum green in 2000 was estimated using the mean date of maximum green between 2001 and 2009.

The LandSat images were subjected to a series of pre-processing steps to control for the atmospheric conditions present at the time of acquisition (Appendix 3.1). After pre-processing, a tasselled-cap transformation was applied which converts the raw data in each image into three separate indices useful as measures of habitat quality (Crist & Kauth, 1986). The first tasselled cap band corresponds to pixel 'brightness' and may be interpreted as the amount of bare ground and senescent vegetation in any given pixel (Crist & Kauth, 1986). Second, is a 'greenness' index, which corresponds to the amount of photo-synthetically active vegetation in the pixel (Crist & Kauth, 1986). The third index is commonly

interpreted as the amount of moisture present on the surface on in the soils of a pixel (Crist & Kauth, 1986). Taken together, these can provide an assessment of rangeland condition (for example see: Flores & Yool, 2007). Degraded rangelands in northern Kenya are characterised by limited soil and surface moisture, substantial areas of bare ground between individual plants, gully formation, a lack of surface litter and a shift in vegetation composition away from perennial grasses to annual varieties (King et al., 2009).

Spatial autocorrelation

Spatial autocorrelation where points located close to each other in space tend to display greater similarity in their values than is randomly expected is common in ecological data (Legendre, 1993). While it is often an important property of ecosystems, it may also confound parametric statistical analyses, which assume independently distributed errors. As a consequence, the statistical significance of predictor variables can be inflated (Legendre, 1993), leading to Type I error. To account for spatial autocorrelation, a series of semivariograms were plotted for the tasselled cap transformed imagery in ENVI 4.4. The semivariogram can be used to ascertain the distance at which the value in each pixel becomes independent (see Curran, 1988for a detailed explanation). Semivariograms were plotted to a maximum lag distance of 100 pixels (3.0 km) to identify small scale spatial autocorrelation. The range was taken to be the distance from a pixel to the smallest local maximum (sill) on the semivariogram. Imagery was sub-sampled to a grid, whose spacing was determined by the range of the semivariogram.

Trends in Vegetation Greenness

The Image Differencing module in Idrisi (Clark Labs) was used to calculate the changes in the greenness value of each pixel across Namunyak, Sera and West Gate, together with their respective matched comparison sites. A standardised rate of change in the form of a z-score was calculated both to ensure comparability in images across the transformed bands and give a threshold for distinguishing significant per-pixel change.

The significance of changes in per pixel vegetation greenness was assessed using one-way analysis of variance (ANOVA) in SPSS. Trends in greenness were compared at the landscape level (all study conservancies/all non-conserved baseline sites), for individual conservancies (Namunyak/non-conserved baseline; Sera/non-conserved baseline; West Gate/non-conserved baseline). In addition, planned contrasts were performed to examine the impact of each management zone on vegetation greenness (core zones/buffer zones/settlement zones/non-conserved baseline).

Trends in 'Wetness' and 'Brightness'

As with trends in vegetation greenness, changes in wetness and brightness over the time series was assessed using Image Differencing. Due to the spatial scale of auto-correlation (section 3.2.1), intra-conservancy assessments could not be conducted and analysis was confined to the landscape and conservancy levels. Trends in brightness and wetness were assessed using independent t-tests and one-way ANOVAs.

3.2 Results

3.2.1 Spatial autocorrelation

Spatial auto-correlation was present in all images, nested at multiple scales (Table 3.2 and Appendix 3.2). The range to the first sill, i.e. the smallest scale at which spatial autocorrelation can be detected, differed both between transformed bands and by season. For the brightness and wetness bands, spatial autocorrelation ranged an order of magnitude from 0.2km to 2km. Sub-sampling data at the higher threshold reduced the sample size considerably, precluding statistical analysis. Consequently, images were sub-sampled at 0.7km, meaning that data was drawn from every 22^{nd} pixel. Spatial autocorrelation was found to be present at a much smaller scale in the greenness band, with a mean of 0.2km. Images sub-sampled at this scale enabled detailed analysis of the zoned management system (section 3.3.2). Greenness images were also sub-sampled to 0.7km to allow a multivariate analysis of trends in rangeland condition to be undertaken (section 3.3.4)

Table 3.2 Spatial auto-correlation in tasselled cap transformed LandSat ETM+ imagery.

Year	Image	Spatial scale at which pixels are independent (km) [Value in square brackets is pixel no.]		
		Brightness	**Greenness**	**Wetness**
2000	Dry Season	2.2 [73.4]	0.1 [4.2]	2.2 [74.4]
	Rainy Season	1.8 [60.0]	0.66 [22.1]	0.08[2.8]
2007	Dry Season	0.67 [22.3]	0.15 [5.0]	0.63 [21.1]
	Rainy Season	0.7 [23.2]	0.1 [4.4]	0.7 [22.9]

3.2.2 Trends in Vegetation Greenness

Between 2000 and 2007, green vegetation increased significantly during both the dry ($t_{(9861)}$=-19.4, $p<0.01$, r^2=0.2) and rainy seasons ($t_{(2738)}$ =-32.2, $p<0.01$, r^2=0.5) in Namunyak and West Gate compared to non-conservancy areas. In Sera, little overall change occurred during the dry season, and this was matched by trends in the non-conserved baseline sites for the conservancy (Table 3.3). This contrasts with highly significant ($p<0.01$) differences in apparent when the same comparison is conducted in the rains.

The small spatial scale of autocorrelation in the transformed greenness band enabled an analysis of intra-conservancy vegetation trends (Figure 3.1). Conservation management is a small but significant factor in determining the trend in green vegetation in the study area ($F_{(3,343)}$ =129.9,p<0.01, $\omega = 0.1$). During the rainy season, significant differences were not only apparent between the conservancies and non-conserved baseline sites ($t_{(79)}$ = 17.9, p<0.01, r^2=0.9) but also within the management zones of the conservancy network as well.

Table 3.3 Trends in the amount of green vegetation in Northern Rangelands Trust conservancies and non-conservancy baseline areas.

	Mean standardised change in green vegetation (Std. Dev)		
Site	Conservancy	Non-conserved baseline	Significance
DRY SEASON			
Namunyak	0.45 (1.39)	0.21 (1.16)	$t_{(5801)}$=-7.2, p<0.01
Sera	0.00 (0.00)	0.02 (0.00)	$t_{(5475)}$=-1.5, n.s
West Gate	0.07 (0.00)	-0.11 (0.00)	$t_{(5706)}$=-8.1, p<0.01
RAINY SEASON			
Namunyak	1.11 (1.60)	-0.41 (0.00)	$t_{(93702.0)}$= -44.4, <0.01
Sera	0.47 (0.00)	-0.20 (0.00)	$t_{(2708)}$=-19.7, p<0.01
West Gate	0.36 (1.01)	0.14 (0.00)	$t_{(115)}$=-2.0, p<0.05

Planned contrasts revealed significant differences between the actively managed core and buffer zones of the conservancies and the unmanaged remainder of the conservancy, here termed the settlement zone. Contrary to expectation, green vegetation underwent significant higher rates of change in the settlement zone, than in the combined core and buffer zones ($t_{(1896)}$=-13.59, p<0.01, r^2=0.3). There was no significant difference between core and buffer zones ($t_{(2335)}$=0.46, n.s).

During the dry season, significant differences between conservation management zones remained ($F_{(3,3251)}$ =74.1, p<0.01, ω=0.1), but the nature of this variation altered. Buffer zones experienced significantly greater increases in green vegetation than core zones during drier periods ($t_{(1910}$ =-6.38, p<0.01, r^2=0.2).

3.2.3 Trends in 'Wetness'

'Wetness' in conservancies during the rainy season declined in the study period ($\bar{x}$ =-0.5 ± SD 0.31), compared to a marginal increase ($\bar{x}$ =0.1 ± SD 1.0) in non-conservancy areas. The difference between conserved and non-conserved areas was significant ($t_{(5442)}$=30.1, p<0.01) albeit with a small effect size (r^2=0.25). This trend reversed during the dry season ($t_{(9954)}$= -9.9, p<0.01, r^2=0.1).

Figure 3.1 Trends in Green Vegetation Index in Northern Rangelands Trust conservancy zones and non-conserved baseline areas.
Bars represent mean values. Error bars represent standard error.

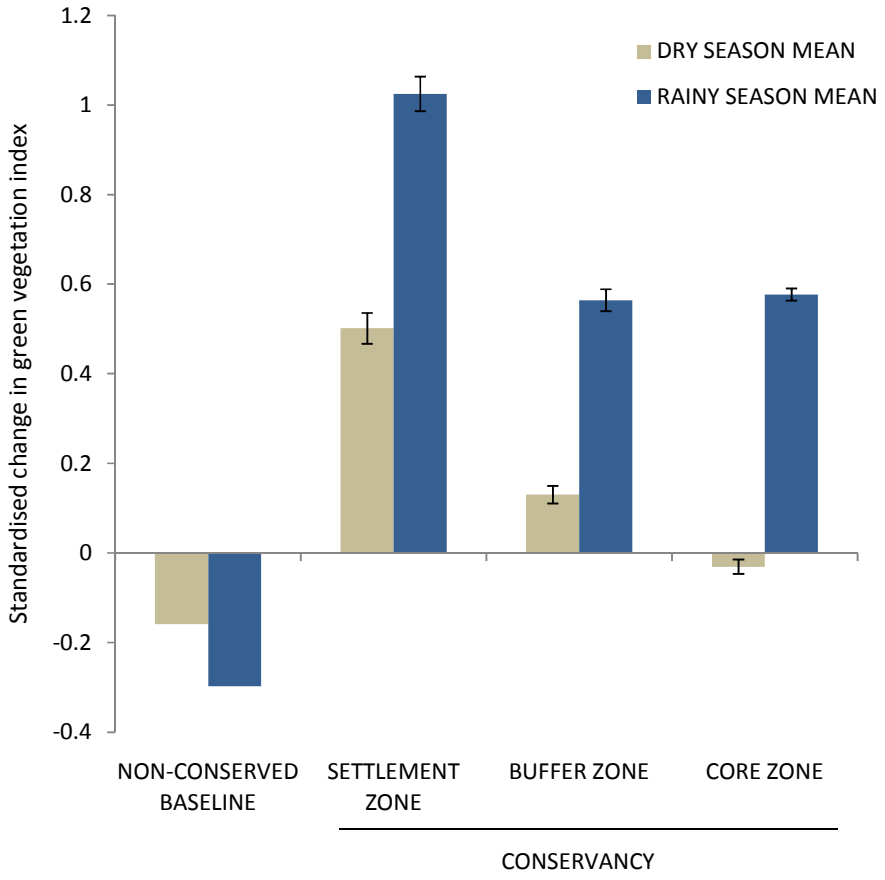


Table 3.4 Trends in pixel moisture in Northern Rangelands Trust conservancies and non-conservancy baseline areas.

	Mean standardised change in pixel moisture (Std. Dev)		
Site	Conservancy	Non-conserved baseline	Significance
DRY SEASON			
Namunyak	0.21 (1.1)	0.06 (1.46)	$t_{(3647)}$=-3.9,p<0.01
Sera	0.13 (0.07)	-0.03 (1.1)	$t_{(617)}$=-4.3,p<0.01
West Gate	0.28 (1.33)	0.01 (0.09)	$t_{(261)}$=-2.0,p<0.05
RAINY SEASON			
Namunyak	0.06 (1.35)	0.43 (0.00)	$t_{(2750)}$= -10.8, p<0.01
Sera	-0.47 (0.00)	0.15 (0.00)	$t_{(2570)}$=-27.4, p<0.01
West Gate	-0.63 (0.04)	1.15 (0.05)	$t_{(1093)}$=-34.3, p<0.01

Individually all three conservancies followed this pattern of relative declines in moisture during the rains, and higher moisture during the dry season (Table 3.4).

3.2.4 Trends in Brightness

Significant differences were apparent between brightness in the conservancies and non-conserved baseline regions during both the rains ($t_{(2732)}$=30.0, p<0.01, r^2=0.25) and the dry season ($t_{(9997)}$= -12.2, p<0.01, r^2=0.1). On a regional scale, declines in brightness in non-conserved areas were significantly higher than seen in non-conserved areas. This tend persists when the three conservancies are considered individually (Table 3.5). Effect sizes were however, small in all cases suggesting that conservation status is only one of a suite of factors affecting trends in brightness.

Table 3.5 Trends in pixel brightness in Northern Rangelands Trust conservancies and non-conservancy baseline areas.

	Mean standardised change in pixel brightness (Std. Dev)		
Site	**Conservancy**	**Non-conserved baseline**	**Significance**
DRY SEASON			
Namunyak	0.17 (0.09)	-0.09 (1.2)	$t_{(551)}$=-7.4, p<0.01
Sera	0.24 (0.00)	-0.65 (0.00)	$t_{(5475)}$=-1.5, p<0.01
West Gate	0.21 (1.62)	-0.03 (0.00)	$t_{(298)}$=-1.6, n.s
RAINY SEASON			
Namunyak	-0.47 (0.03)	-0.56 (0.03)	$t_{(2750)}$= -10.8, p<0.01
Sera	-0.15 (0.00)	-0.07 (0.00)	$t_{(2570)}$=-27.4, p<0.01
West Gate	0.30 (0.04)	-0.73 (0.00)	$t_{(112)}$=-8.5, p<0.01

3.2.5 Overall trends in habitat condition

Combining the data presented in sections 3.2.2 to 3.2.4 above, a distinct seasonality emerges. In the dry season, all three indicators increase significantly compared to the non-conserved baseline. After the rains, however, wetness declines significantly, while greenness and brightness both increase significantly in the conservancies relative to the wider landscape (Figures 3.2 & 3.3)

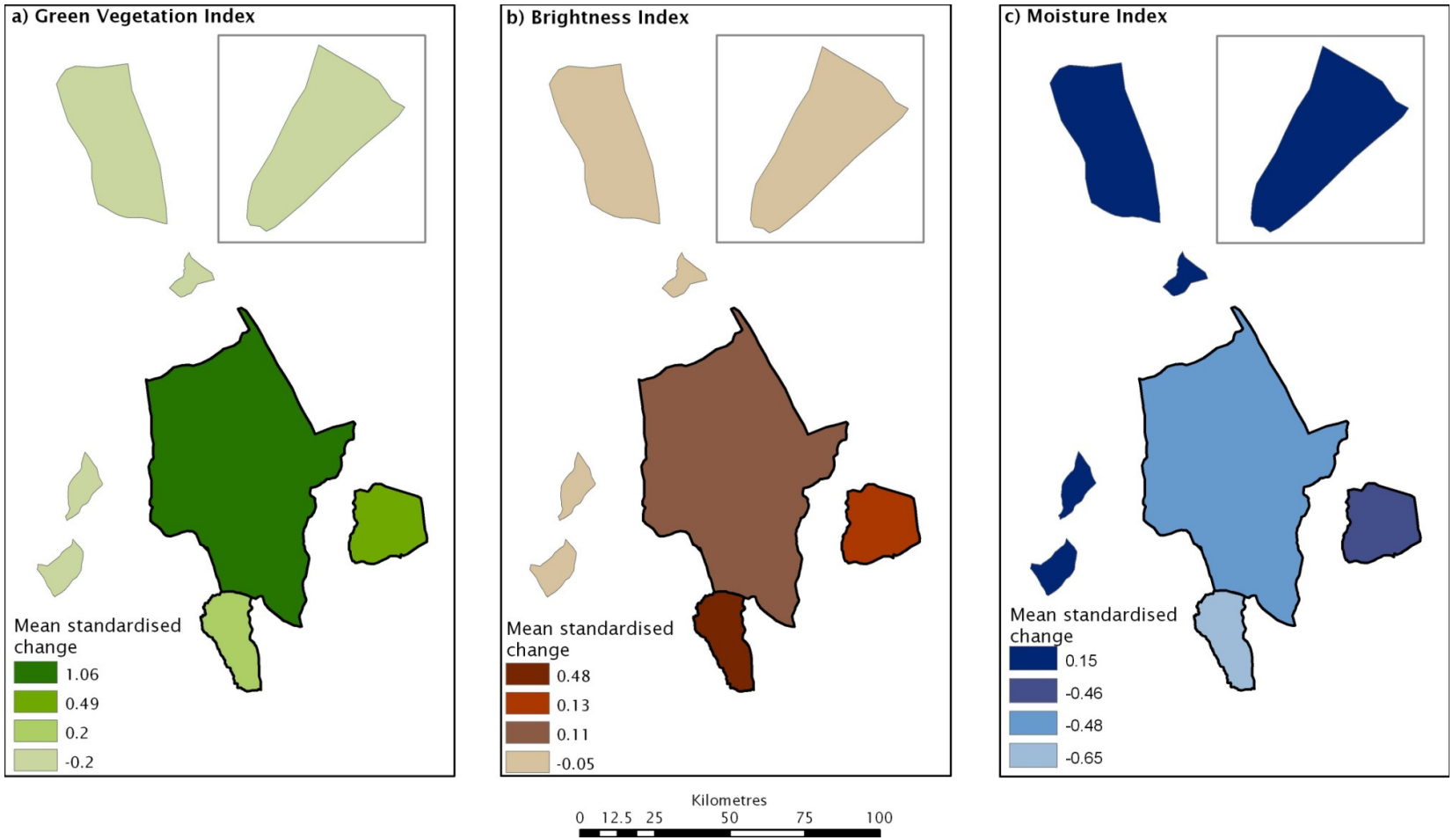
3.3 Discussion

Significant changes have occurred in habitat condition in NRT conservancies compared to equivalent non-conserved sites. These impacts are apparent on a regional scale, in individual conservancies and within different grazing management zones.

3.3.1 Conservancy-level changes

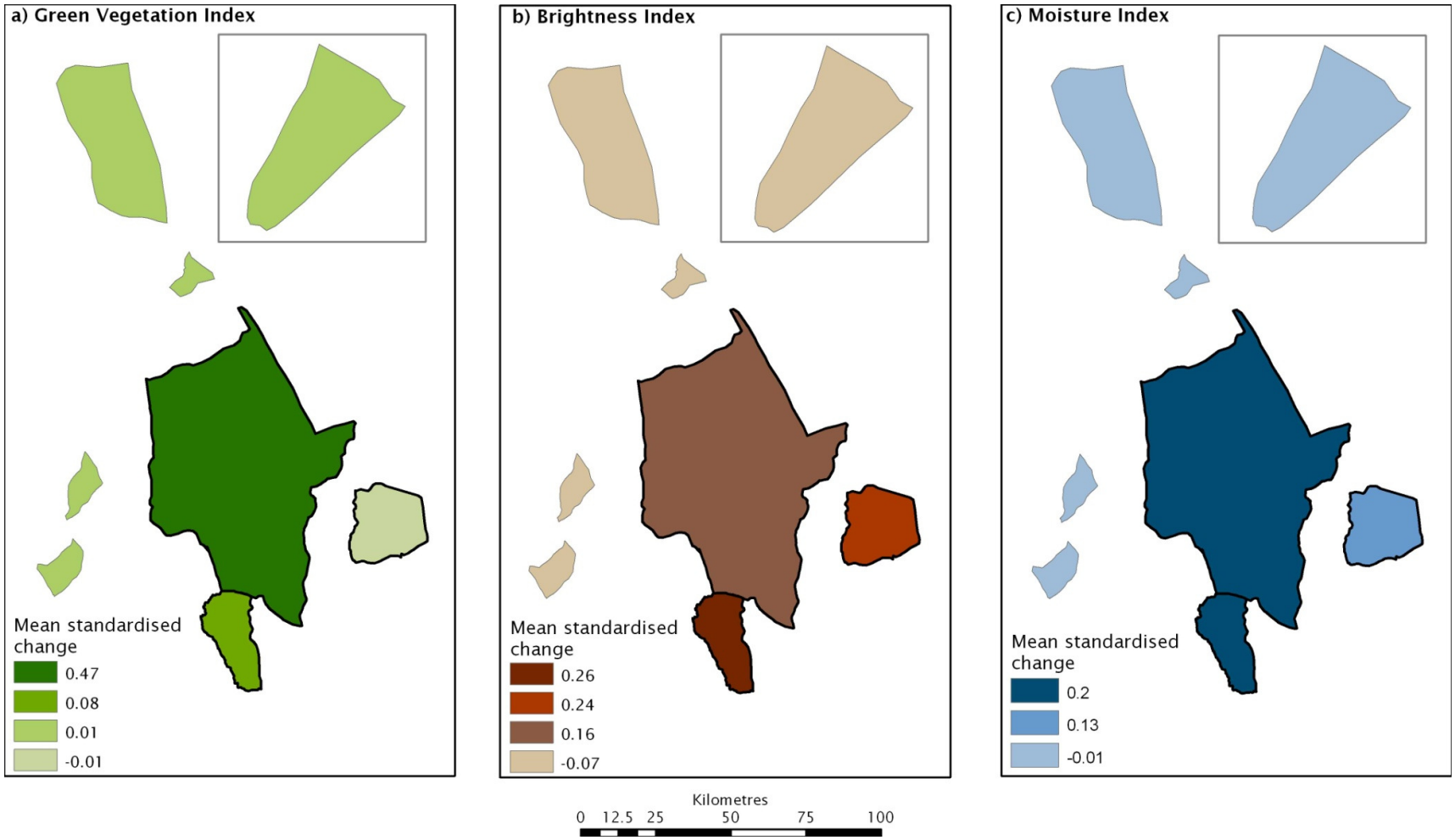
Individual conservancies mirror the trends apparent on a regional scale. In both seasons, conservancies have experienced significantly greater increases in the green vegetation index than the non-conserved baseline.

Figure 3.2 Changes in rainy season pixel 'greenness', 'brightness' and 'wetness' indices in Northern Rangelands Trust conservancies and non-conserved baseline sites between 2000 and 2007.



NRT conservancies are shown in bold outline and non-conserved baseline sites with a thin outline.

Figure 3.3 Changes in dry season pixel 'greenness', 'brightness' and 'wetness' indices in Northern Rangelands Trust conservancies and non-conserved baseline sites between 2000 and 2007.



NRT conservancies are shown in bold outline and non-conserved baseline sites with a thin outline.

This is indicative of an increase in the extent or productivity of photo-synthetically active vegetation within community conserved areas.

This increase in vegetation growth is also responsible for the trends in brightness and wetness values in the conservancies. The brightness index represents the 'yellow' component of the tasselled cap spectrum (Kauth & Thomas, 1976) and has been interpreted as representing senescent vegetation and leaf litter (Crist *et al.,* 1986), as well as bare ground (Todd & Hoffman, 1999). Where associated with the changes in soil moisture and green vegetation observed in conservancy areas, it would appear to represent increased senescent vegetation rather than increasing bare ground. The accumulation of yellowing leaf litter during the dry season, increases soil moisture as it decomposes, and prevents moisture loss through direct evaporation from soils (Lechmere Oertel *et al.,* 2005). In remotely-sensed image, this would translate to a relative increase in both soil moisture and brightness during the dry season, as seen in NRT conservancies. During the rains, the presence of leaf litter increases brightness but reduces wetness indices due changes in infiltration by precipitation (Mwendera & Saleem, 1997). Leaf litter increases infiltration capacity, enabling water to percolate into the soil profile rather than remaining as surface run-off (Stroosnijder, 1996; Mwendera & Saleem, 1997).

Green vegetation and leaf litter have increased in community conserved lands when compared to equivalent non-conserved land in the region. Increased vegetation and ground cover have been identified by both scientists and local pastoralists (King *et al.,* 2009; Roba & Oba, 2009) as indicators of a healthy rangeland environment. Consequently, it may be concluded that community conservation has led to an increase in rangeland condition in participating areas of northern Kenya.

3.3.2 Impact of zoned management on habitat condition

Management zones within the conservancies have significant impacts on the trends in green vegetation year-round. All zones have experienced significant increases the amount of green vegetation when compared to non-conserved areas. Interestingly, it is outside of the zones of active grazing management that the largest changes have occurred. In this settlement zone, formal grazing management by the conservancies has not taken place and consequently community members are not restricted from grazing their livestock in this area.

While formal management is not place, informal community practices linked to the presence of a conservancy may be responsible for the increase in photo-synthetically active vegetation in the settlement zone. Where a community sees the livelihoods benefits of conservation, they may become more to adopt sustainable practices across a wider area (for example see: Walpole & Goodwin, 2001). In the case of the settlement zones of the conservancies, the 'conservation ethic' may have aggregated to include the management of timber resources. When questioned about the availability of timber resources, households in conservancy communities frequently reported awareness campaigns related to timber run by the conservancies (section 4.3.7.8). These campaigns emphasised the importance of retaining tree cover, through the use of dead rather than live timber as fuel and refraining from cutting live foliage for livestock fodder. If such practices have been

widely adopted, an increase in tree cover could explain the increase in photo-synthetically active vegetation in the area. However, due large scale spatial auto-correlation present in the brightness and moisture bands, only the green vegetation component could be used to examine differences between conservancy zones. Consequently further research may be required to identify the mechanism behind the marked increase in green vegetation in the settlement zones.

Seasonal differences were also apparent between the core and buffer zones of conservancies. In the rainy season, there is no significant difference in the vegetation greenness trend. However, when the dry season time series is examined, green vegetation in the buffer increases significantly compared to that in the core zone. This is likely to be the product of the differing grazing management regimes in these zones. During the rains, when grazing is available elsewhere, livestock are excluded from the buffer zone, to ensure a reserve area of grazing remains intact for the dry season. Consequently in this season, the buffer zone has the same *de facto* management status as the core area. During the dry season, however, the management regime differs. If the grass reserve is required, community elders can decide to lift the restrictions on the buffer zone and allow livestock to graze the area. The core remains a 'no-take' zone, except during severe drought. It is this dry season grazing by livestock herds which is responsible for the greater increase in green vegetation in the buffer zones.

Grazing by livestock has been shown to increase in photosynthetic activity through a variety of mechanisms. In the Serengeti, a grass-dominated rangeland, grazing stimulates net primary productivity (McNaughton, 1984). Seasonal discrepancies in this effect were also apparent in this system, where the accumulation of biomass at the end of the rainy season masked the effects of herbivory (McNaughton, 1984). The creation of high productivity stands by herbivory is also apparent in more arid shrub-dominated rangelands. In South Africa, Fornara & du Toit (2007) reported that the removal of green vegetation through herbivory stimulates higher re-growth rates in affected *Acacia* stands, creating a 'browsing lawn'.

In addition to the mechanical impacts of grazing upon plant production, livestock herds may also deposit considerable amounts of dung in an area, which may both increase soil moisture retention and acts as a fertiliser (Augustine *et al*., 2003) Livestock may also enhance seed dispersal & establishment, via the consumption and subsequent deposition of intact seeds (Miller, 1996; Milton & Dean, 2001), the suppression of seed predators (Goheen *et al.,* 2010) and the removal of under-storey grasses (Goheen *et al.,* 2010). It should be noted, however, that such mechanisms also facilitate the downward leaching of nutrients through the soil profile, increasing shrub encroachment and potentially degrading the habitat (Dougill *et al.,* 1998).

It is important to note that while habitat condition, when measured as the amount of green vegetation, has increased at a greater rate in buffer zones than in the 'no-take' core, this does imply that the core zones should be converted to the buffer zone management regime.

Core zones may have an important function in maintaining the populations of livestock-intolerant species as well as providing a grazing reserve for wildlife during periods of drought. Human settlement and their associated livestock herds may actively repel wild ungulates, through a combination of disturbance and the poor forage quality associated with intense grazing (Ogutu *et al.,* 2010). Avoidance of human-related disturbance by livestock and domestic dogs has been identified as a factor in the distribution of ungulates in northern Kenya, with Beisa Oryx (*Oryx gazelle beisa*), Giraffe (*Giraffa camelopardis*) and Gerenuk (*Litocranius walleri*) displaying particular sensitivity (de Leeuw *et al.,* 2001).

4. Socioeconomic outcomes of community conservation

In their vision of success for northern Kenya's pastoralist communities, NRT aims to achieve the coexistence of people and wildlife, greater opportunities for diverse livelihoods particularly those based on natural resources, access to health care and education, and gender equity (NRT, 2007). The socioeconomic component of this research aimed to assess the extent to which these aims are being achieved and under what conditions.

4.1 Methodology

Socioeconomic outcomes were assessed using a series of household interviews in the three focal conservancies and their matched comparison communities (section 3.1.1). Using the strategic aims of NRT, indicators were developed to measure trends in income composition and livelihoods.

The indicator set adopted the household as the primary socioeconomic unit and defined this as those individuals resident in the same house or cluster of houses, whose income is shared between other members of that household. Livelihoods were conceptualised as the product of the assets and opportunities available to a household, mediated by both the ability of households to utilise them and risk of illness or insecurity (Figure 4.1)

Households to be interviewed were selected using a participatory wealth ranking technique to ensure appropriate representation of all socioeconomic strata in the sample (Kumar, 2002). Wealth ranking was undertaken by a group of community members who were instructed to place each household into a group based on socioeconomic status. A map drawn by a community member was provided during the exercise to ensure all households were included. Once a consensus had been achieved, households were sampled randomly from within each stratum.

The household interview (Appendix 4.1) was designed to gather data on basic demographic and socioeconomic factors as well as assess changes in income and livelihood using a total of 53 indicators. Changes in both income and livelihood indicators were measured using a simple scoring system and flashcards. Each indicator was represented by a simple flashcard and respondents were asked to score the level of change that had occurred during the study period (Figure 4.2). These methods have their origins in participatory rural appraisal and have been applied to the measurement of poverty across the developing world (Kumar, 2002)

Figure 4.1 World Bank Livelihood Framework

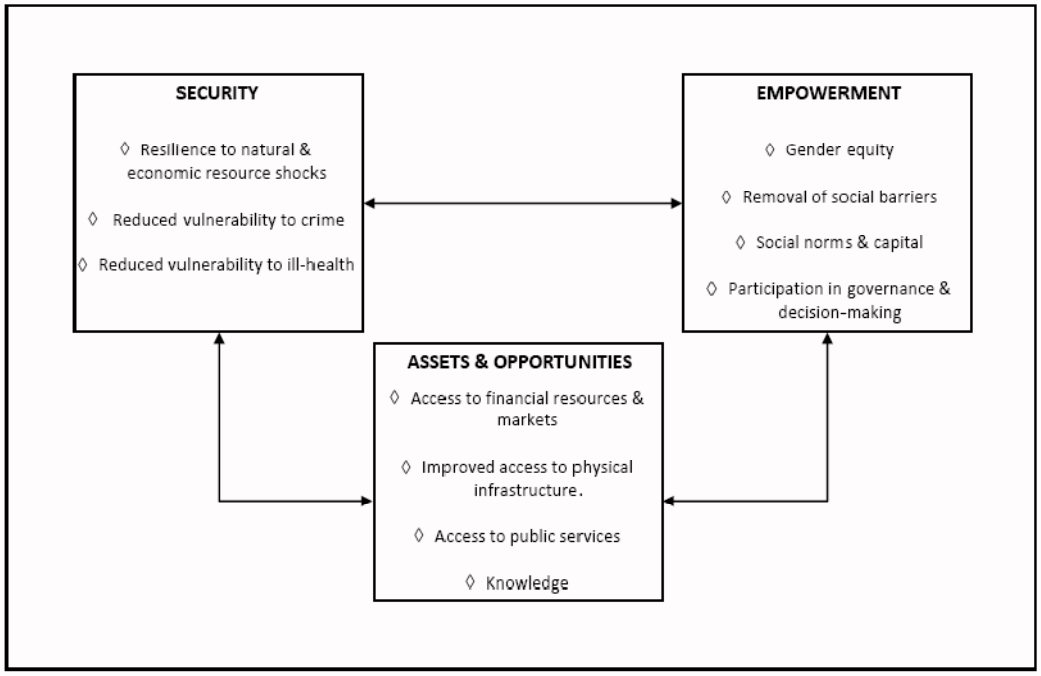
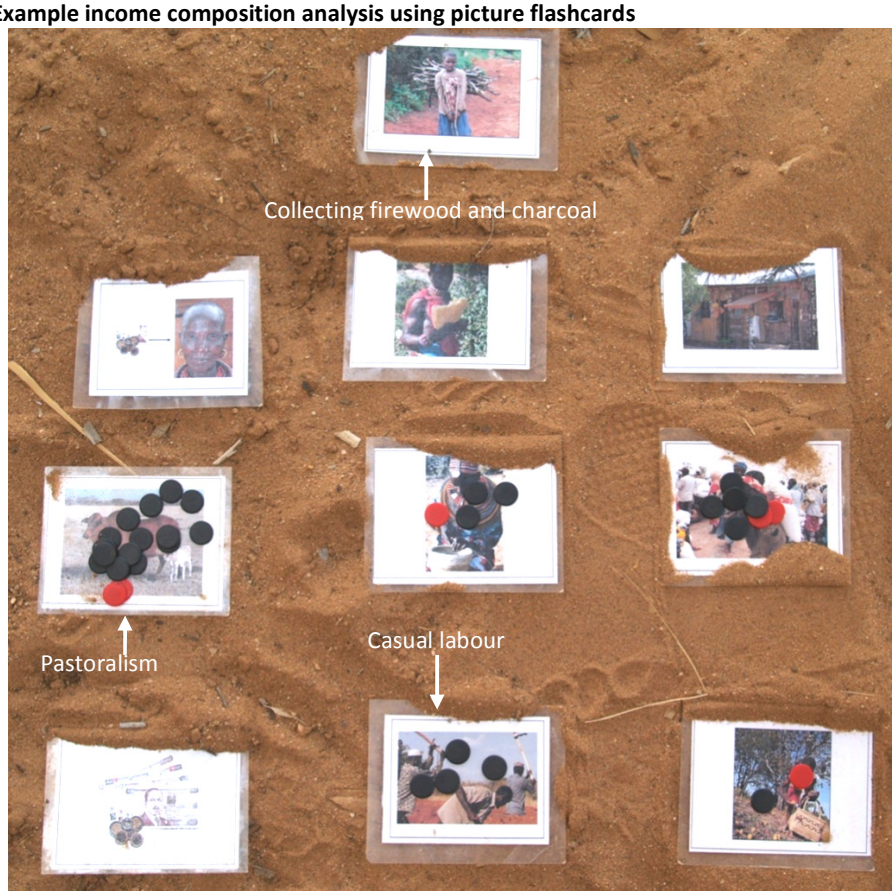


Figure 4.2 Example income composition analysis using picture flashcards



(L. Glew, 2009)

Households selected for inclusion in the study were approached by a local facilitator who requested an interview. Where households accepted the initial request, the research team comprised of the lead researcher plus a local translator explained the purpose of the interview, the type of questions to be asked and the intended use of the data. Householders were asked to consent to the interview. Where a household declined, a replacement from the same wealth stratum was identified and an interview requested. Replacements were also made if the household heads were unavailable for interview on three separate occasions.

Interviews were conducted by the lead researcher, with translation into either KiSwahili or local tribal language provided by a translator. All translators used were from the local community. Where the translator was not from the village being sampled, they were accompanied by a village elder when making the initial interview request. The use of local translators was designed to build trust with community members. Where possible, the research team camped in community being sampled, to break down barriers between the foreign-led research team and local people. Interview length varied on the amount of information offered by respondents but typically lasted between 30 and 60 minutes. At the end of each interview, participating households were given a small amount of sugar and tea to compensate them for their time. This builds on cultural tradition in the region, whereby individuals wishing to speak to an elder would bring a gift of sugar, tea or tobacco to the household.

Interviews were divided into four stages. The first gathered basic demographic data on respondents and their households. The second considered trends in overall income and relative importance of various income-generating activities. The final two sections measured the trend in livelihoods indicators, and gathered data on household participation in community decision-making.

4.1.1 Demographic characteristics

Previous research has highlighted the importance of basic demographic and socioeconomic characteristics in determining perceived outcomes of community conservation. Data on the age and gender of respondents was recorded, together with information on ethnicity and length of residency in a community. Where community members felt comfortable in disclosing the information, the size of each household livestock herd was recorded as numbers of camels, cows and small stock (the mixed herd of sheep and goats).

4.1.2 Trends in income composition

The measurement of income composition and diversity required households to score the contribution of various income-generating activities to their livelihood before and after the date of conservancy establishment, in both the dry and rainy seasons. The activities shown on the cards were selected after pre-testing a broader set of income-generating activities among pastoralists in the region. At each time period (dry/rains; before/after conservancy establishment), respondents were asked to record the proportion of income generated by a particular activity (Figure 4.2).

Overall income trend

Based on the 'At Least Do No Harm' principle, conservation projects are should aim to at least maintain livelihoods at their pre-project baseline (IUCN, 2004). To assess whether the NRT conservancies meet this target, households were asked to report the trend in their absolute income during the study period. After scoring the composition of their income before and after conservancy establishment, householders were asked to describe whether their overall income had changed in that time period. Respondents were asked to select which of a set of descriptors matched the trend in their income most closely. These were 'declining', 'stable' or 'increasing'. Where respondents were too young to have an independent income prior to conservancy establishment or did not know the answer, income trend was recorded as unknown.

Dependence on relief assistance

Households in northern Kenya have high dependence on relief assistance, both in the form of emergency food aid during droughts and as long-term livelihood support. High or increasing dependence upon relief is indicative of an unsustainable livelihood, which cannot provide ***sufficient*** resources to a household. In this survey, the number of households in an area utilising relief and the mean proportion of income derived from relief in an area were examined.

Employment

Access to paid employment is limited in northern Kenya and constrains wider development (Little al., 2007; Malleret-Hatfield & King, 2008b). The trend in the number of households employed in a community and the mean proportion of income derived from salaries was compared in conservancy and non-conservancy communities.

Alternative incomes

A diverse livelihood built on income derived from a variety of different sources is a more sustainable than one which relies heavily on a single resource (Scoones, 1998). Incomes made up of multiple components are more likely to be buffered against resource shocks affecting a single resource (Esilaba, 2005). The trends in income diversity, measured as the number of income components at the household level was assessed for both dry and rainy seasons.

Income composition profiles

Overall change in income generating activities was assessed at the conservancy level. Changes in the mean proportion of income derived from a particular activity were assessed, and trends compared between conservancy and non-conservancy communities.

4.1.3. Livelihood trend

Livelihoods, defined as 'the capabilities, assets (including both material and social resources) and activities required for a means of living' (Scoones, 1998:5), were assessed using the World Bank Poverty Framework (World Bank, 2001). This views livelihoods as the complex product of the opportunities available to a household, the security in which those opportunities may be exploited, and the level of empowerment possessed by a household or community. A livelihood is classed as sustainable when it is resilient to resource shocks or chronic stress and is stable or improving without compromising the integrity of the resources upon which it is based (Scoones, 1998).

The initial indicator set was developed and pre-tested by Malleret-King & Hatfield (2007a & b) in their assessment of the livelihoods outcomes of Samburu National Reserve and Lekurruki, one of the NRT Conservancies. A pilot survey conducted in the Ntepes area of Namunyak Conservancy was used to refine this indicator set to 21 measures of livelihood (Table 4.1).

In this section of the interview, the number of plastic counters placed on a flashcard by the respondent represented the proportional change which had occurred during the time periods in question.

Table 4.1 Livelihoods indicators used to assess the socioeconomic outcomes of three Northern Rangelands Trust Conservancies, Kenya

Livelihood Component		Indicator
Security	Social Cohesion	Physical Security
		Security from human-wildlife conflict
	Health	Awareness of medical care
		Access to medical infrastructure
		Affordability of medical care
Opportunities	Income	Access to paid employment
		Access to alternative livelihoods
		Fines
	Education	Awareness of education
		Access to affordable primary education
		Access to affordable secondary education
	Transportation	Access to roads
		Access to affordable transportation
	Natural Resources	Availability of grazing
		Quality of accessible grazing resource
		Access to firewood or fuel products
		Access to timber
		Access to water for the household
		Access to water for livestock
Empowerment	Participation	Participation in local decision-making

Trends in livelihood security

According to theory, a sustainable livelihood is one which has low vulnerability to economic or natural resource shocks, violence or ill health (Scoones, 1998). In the current study, livelihood security was measured as the mean proportional change in indicators relating to access to medical care, physical security, and the prevalence of human-wildlife conflicts.

Northern Kenya is prone to insecurity, much of which stems from competing resource demands and inter-tribal tensions (CDC et al., 2009). In recent years, insecurity has been fuelled by an influx of illicit weapons from the Horn of Africa and frequent drought (CDC et al., 2009). Consequently, trends in the physical security of households were assessed and compared for conserved and non-conserved areas.

Amongst the predominantly pastoralist communities in the region, livelihoods can also be threatened by human-wildlife conflict. This centres on access to grazing and water resources (e.g., Thouless, 1994) as well as the depredation of livestock by large carnivores (e.g., African Wild Dog; Woodroffe et al., 2005). In the survey, households were asked to report any changes in the frequency or intensity of human-wildlife conflict experienced by their household or community. Where a respondent reported human-wildlife conflict occurring or a change in its prevalence, the species involved was recorded.

Trends in empowerment

Empowerment was measured as the level of participation in village or community decision-making reported by a household. Respondents were asked to describe their involvement, with responses coded by researchers into 'no participation', 'passive participation' or 'active participation'. Further surveys on institutional governance were undertaken to broaden this indicator set. To date, however, the sample size of a survey on institutional governance is too small for analysis.

Trends in assets and opportunities

Assets and opportunities were grouped into four main categories relating to the ability of households to access transportation, education as well as natural and financial resources. For each asset, sub-sets of indicators were used to identify the specific changes occurring.

4.1.4 Focus Group Discussions and Key Informant Interviews

Findings from data gathered at the household level were cross-checked with a series of focus group discussions held in three conservancy communities in April 2010. A semi-structured discussion was used to generate a list of major socioeconomic impacts of each conservancy, which were subsequently ranked in order of importance

As Samburu society is patriarchal and gerontocratic, decision-making at the community level is typically dominated by middle-aged or elderly men (Spencer, 2004). Women and *moran* (the warrior class of young men) are typically excluded from discussions and decision-making on community matters (Spencer, 2004). Cultural tradition also limits the contact permitted between *moran* and women outside their nuclear family (Spencer, 2004).

As a consequence, homogeneous focus groups in each community were conducted with the three distinct demographic groups. Groups were ordered to ensure that the opinions of elders did not bias data collected from *moran* and women. As a consequence, in each community a strict order was maintained, with women's' groups held first, followed by *moran* and finally *wazee* [elders].

Participants were selected from the community members in the immediate vicinity of the focus group's location with the assistance of community leaders and conservancy staff. All community members were eligible for participation, except those who are directly employed in a conservancy management role. Focus groups were conducted in KiSamburu with simultaneous translation for the English-speaking researcher. All discussions were recorded using a digital voice recorder and transcribed in English.

Each focus group was divided into three sections (Appendix 4.2). Firstly, participants were asked to compile a list of socioeconomic impacts attributable to the conservancy in their area and place those impacts in order of importance. Once consensus had been achieved, the second stage of each focus group gathered detailed responses from participants on the nature of those impacts, their implications for the community and any challenges or obstacles to their implementation. Finally, participants were given the opportunity to expand upon any issues they felt had been inadequately covered or which they wished to discuss.

In addition, a series of key informants with particular insight on the history, strategy and impact of the NRT were interviewed between April and June 2010.

4.2 Results & Discussion

Semi-quantitative socioeconomic surveys were conducted between June 2009 and April 2010 in Samburu and Marsabit Districts, northern Kenya. A total of 542 households living in 29 communities were sampled during this period. After the removal of incomplete or potentially erroneous data[1], information from 512 separate households was used in the analysis. As some communities acted as matched comparison sites for multiple conservancies, the final sample size was 670 households. Non-response rate was low, with 1.5% of all randomly selected respondents refusing to participate in the survey. A further 6.6% of respondents were

[1] The data collected from households where the primary respondent was clearly under the influence of alcohol at the time of interview were excluded prior to analysis.

successfully replaced by other households randomly selected from within the same wealth stratum after being reported as unavailable on three or more occasions when researchers visited the household.

4.2.1Demographic characteristics

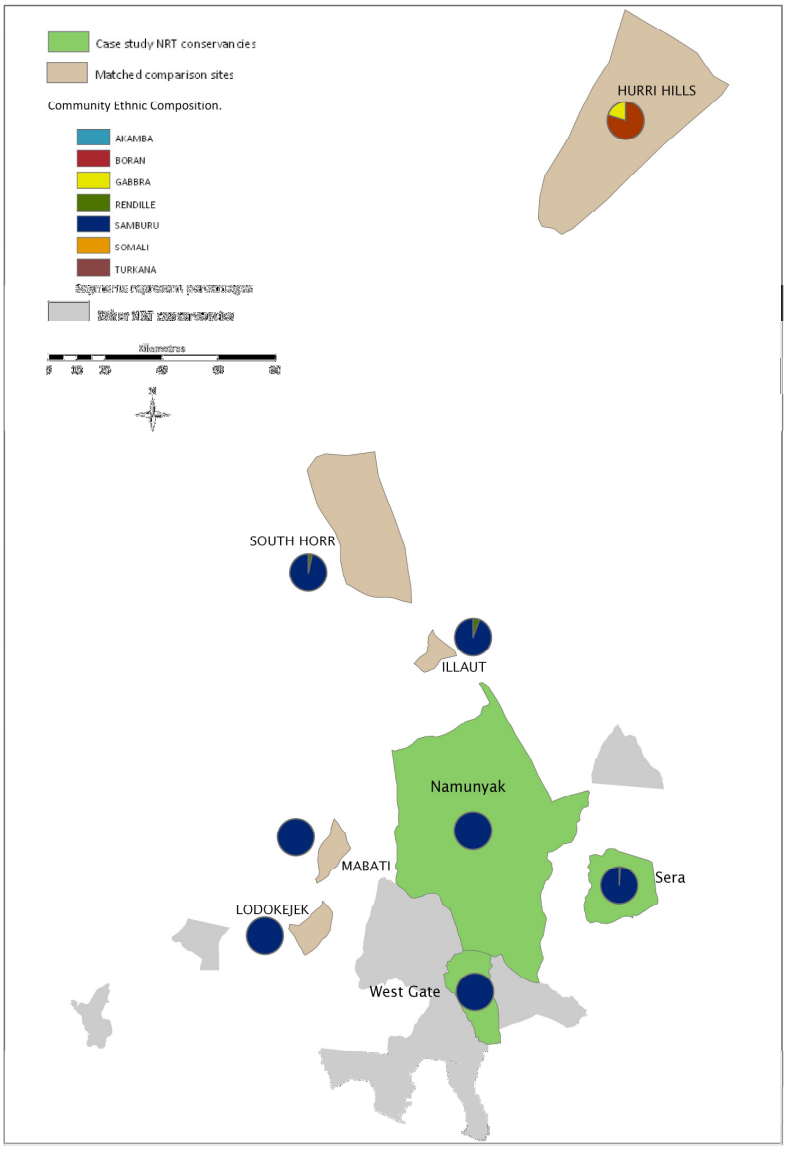
Interviewed heads of household ranged in age from 15 years to 90 years ($\bar{x}$ = 41.2 ± SD 16.4 years). The majority were women, who comprised 71.1% of the total sample. This bias may be the product of three factors. Firstly, in many pastoralist communities young men between the adolescence and approximately 30 years are considered 'warriors' whose role is to protect the community from threats to their physical security (Spencer, 2004). During their time as warriors, men have limited interaction with women outside their nuclear family and seldom marry, with the result that there is often a significant age gap in between husband and wife (Spencer, 2004). Consequently, in later life, an increasing proportion of households become female-headed. Secondly, upon explaining the information required to the household, male respondents frequently stated that he had limited knowledge of some of the issues to be discussed and requested the interview be conducted with his wife. Thirdly, the presence of the female lead researcher at each interview may have meant that women rather than men felt comfortable disclosing sensitive information.

Eight tribal groups were represented in the dataset, with those describing themselves as 'Samburu' dominating the sample (81.3%). The non-Samburu minority included individuals from the Akamba, Ariaal, Boran, Gabbra, Rendille, Somali and Turkana ethnic groups and exhibited considerable spatial variation in size and composition (Figure 4.3). Ethnic composition in Sera and West Gate differed significantly from that in their respective comparison sites (Sera: χ^2_1=84.4, p<0.01; West Gate: χ^2_1=80.2, p<0.01). In contrast, ethnic variation between Namunyak and its matched comparison sites was not significant (χ^2_1=0.3, ns).

Households ranged in size from one to 34 individuals. The mean household had 8.1 (± SD 4.9) members, comprised of 2.1 (± SD 1.0) adults and 6.0 (± SD 4.3) children. The dependency ratio, defined as the number of dependent children or adults per working age adult, was 3.1 (± SD 2.02).

Households were relatively sedentary, having been resident in the same community or land management unit for an average of 19.0 ± SD 16.6 years. Significant differences ($t_{(618)}$= -6.392, p<0.01)in residency were apparent between conserved and non-conserved areas, with communities in NRT areas reporting a mean residence of 23.3 ± SD 17.3 years compared to equivalent non-conservancy communities whose mean residency was 15.24 ± SD 15.0 years.

Figure 4.3. Ethnic composition of case study conservancies and their matched comparison sites.
Hurri Hills acts as a comparison site for Sera and West Gate; Illaut for Namunyak and Sera; Lodokejek for West Gate; Mabati for Namunyak and West Gate; South Horr for Namunyak and Sera.



4.2.2 Income composition and trends

In all communities, pastoralism formed the major income-generating activity. Across the region, 83.0% of households were engaged in livestock production as a component of their income and for just over half (52.6%) their herds formed their primary source of income. While communities in conserved areas contained a comparable proportion of livestock owners to matched non-conserved areas (Z=-0.5, n.s.), there were significant differences in the size (Table 4.2) and composition of livestock herds (Table 4.3). It remains unclear,

however, whether these differences are due to underlying differences between conserved and non-conserved areas, or are an artefact of the 2009 drought. The proportion of income derived from livestock declined less rapidly in conservancies ($Mdn_{(NRT)}$=-7.9 ± SIQR 1.0)[2] than in non-conservancies ($Mdn_{(MCS)}$=-8.3 ± SIQR 1.0) during the study period, however these differences were not significant (U= 37817.0, z=-5.24, n.s).

Table 4.2. Comparison of livestock herd size between conservancy and non-conservancy communities.

Site	Mean herd size (Std. Error) (Tropical Livestock Units per Household)		Significance
	Conserved	Non-Conserved	
Namunyak	13.7 (± 3.2)	3.7 (± 0.3)	$t_{(120.1)}$=-3.1, p<0.01
Sera	5.48 (± 0.9)	3.6 (± 0.4)	$t_{(141.1)}$=-1.8, n.s.
West Gate	6.0 (± 0.9)	3.8 (± 0.4)	$t_{(125.2)}$=-2.1, p<0.05

Table 4.3 Herd composition in conserved and non-conserved regions of northern Kenya.

Site	Conservation Status	Mean head of livestock per household (Std. Error)		
		Shoats*	Cattle	Camels
Namunyak	Conservancy	32.7 (5.76)	9.41 (2.3)	0.7 (0.3)
	Non-conserved baseline	8.7 (0.8)	2.0 (0.2)	0.6 (0.1)
Sera	Conservancy	16.4 (2.7)	3.2 (0.67)	0.4 (0.1)
	Non-conserved baseline	7.6 (0.8)	2.5 (0.3)	0.3 (0.1)
West Gate	Conservancy	18.4 (2.6)	3.9 (0.7)	0.2 (0.1)
	Non-conserved baseline	7.9 (0.8)	2.3 (0.3)	0.5 (0.1)

*refers to the mixed herd of sheep and goats

Income trend

Participation in conservation has had little impact on the overall trend in income diversity in conserved communities. NRT conservancies have undergone no significant increase in income diversity, measured as the number of income-generating activities used to sustain a household when compared to non-conservancy sites in either the rainy season (Z=1.069, n.s) or the dry season (Z=-0.535, n.s).

[2] As the data presented are non-parametric, it is appropriate to quote the median and semi-inter-quartile range (SIQR) as the measures of central tendency and variance, respectively. However, as data for livelihoods indicators, is centred on zero (i.e. the no-change condition), the median and SIQR may both be zero. Throughout the text, the median for a conservancy is denoted by $Mdn_{(NRT)}$ and that for non-conserved matched comparison sites by $Mdn_{(MCS)}$. Both are quoted with an associated SIQR value. For parametric data, the values quoted are mean ($\bar{x}$) and standard deviation (SD) unless otherwise specified. Significance values are given at 5% (p<0.05) or 1% (p<0.01). Non-significant results are denoted by 'n.s'.

84.0 % of households reported that their income had either remained stable or increased, while in non-conserved areas significantly fewer (43.8%) did so (χ^2_1=115.8, p<0.01). This implies that the conservancies act as a safety net for communities, buffering households from income declines.

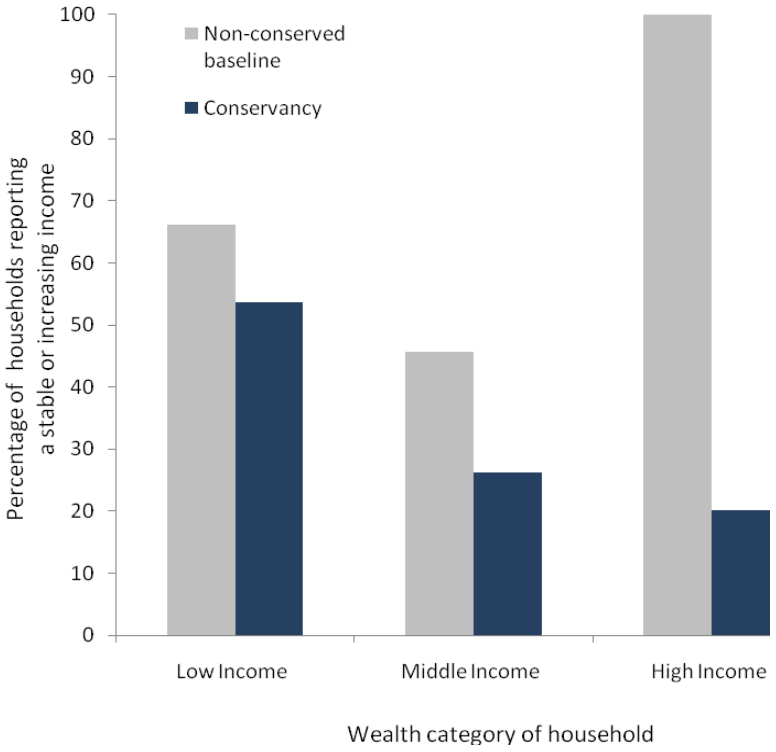
Income trend in conservancies varied by socioeconomic group (Table 4.4), with households in lower wealth strata more likely to report a stable or increasing income than their wealthier equivalents (χ^2_5=13.1, p<0.05; Figure 4.4). This is in contrast to the variation seen in non-conserved areas, where households in the highest wealth category were 1.5 times as likely to report a stable or increasing income, than their poorer neighbours (χ^2_5=48.1, p<0.01). Effect sizes for both of these relationships were, however, small (Cramer's V= 0.18 and V=0.38 respectively) suggesting that wealth stratum is not the only factor driving income trends, particularly in conservancy communities.

Table 4.4 Household wealth category definitions.

Category		Description of household income	Head of livestock			Minimum herd size (TLU†)
			Shoats*	Cows	Camels	
1. High income	A	Major livestock owners with mixed herds of camels, cows and shoats. OR Households with regular salaried employment.	≥21	≥40	>5	35.0
	B	Households with a sizeable livestock herd (camels-cows-shoats), often supplemented by small-scale enterprise.	≥20	20-39	1-4	17.0
2. Middle	A	Moderate livestock herd comprised of cows and shoats, often supplemented by casual labour or small-scale enterprise.	11-19	11-19	0	8.8
	B	Small livestock herd of cows and shoats, frequently supplemented by charcoal production or casual labour.	6-10	6-10	0	4.8
3. Low	A	Minimal livestock herd, supplemented by casual labour and relief assistance.	≤5	≤5	0	0.8
	B	Households dependent on relief and wild resources. Income primarily generated through sale of charcoal or collection of wild fruits.	0	0	0	0

*refers to the mixed herd of sheep and goats. † TLU: Tropical Livestock Units.

Figure 4.4. Percentage households reporting a 'stable or increasing' income across wealth groups in conserved and non-conserved areas of northern Kenya.
For detail on wealth groups please refer to Table 4.4



A logistic regression model predicts that reported trend in income is influenced by multiple factors (Table 4.5). Male respondents who have lived in conservancy communities for a relatively long period of time and who occupied the highest wealth stratum were the most likely individuals to report a stable or increasing income.

Table 4.5. Logistic regression model of income trend in northern Kenya.

Predictor	B (Std Error)	95% Confidence Interval for Odds Ratio		
		Lower	Odds Ratio	Upper
Household in high income wealth stratum	1.83* (0.49)	2.40	6.24	16.28
Conservancy status	1.65* (0.22)	0.13	0.19	0.29
Household in middle income wealth stratum	-1.68* (0.5)	0.01	0.10	0.51
Livestock/relief form primary income.	1.20* (0.32)	1.77	3.32	6.24
Gender (Female)	-0.57* (0.23)	0.36	0.58	0.89
Age (years)	-0.31* (0.01)	0.96	0.97	0.98
Residency (years)	0.02* (0.01)	1.01	1.02	1.03

Note: R^2 =.24 (Cox & Snell), .33 (Nagelkerke). Model χ^2_7=173.8, p. <0.01. * Significant at p<0.01.

Dependence upon relief assistance

Relief dependence across northern Kenya is high, with the majority of households in both conserved (90.6%) and non-conserved (95.4%) reporting it to be a component of their income. Relief dependence has increased across the region during the study period (Table 4.6), due to a series of severe droughts. In 2009, the proportion of households requiring food relief was 11.8% higher than in 1995. The participation in a conservancy had no significant impact on the trend in the number of households requiring relief in either dry (Z=-0.44, n.s) or rainy seasons (Z=-1.34, n.s). However, households in Namunyak have undergone a significantly smaller increase in the proportion of their income derived from relief than non-participating households in both dry (U=3351.5, z=-3.24 p<0.01) and rainy seasons (U=3461.0, z=-4.31 p<0.01). This trend is not apparent in the younger Sera or West Gate conservancies.

Table 4.6. Mean change in proportional income derived from relief assistance in conserved and non-conserved areas.

Site	Mean Change in Dry Season (SE)		Mean Change in Rainy Season (SE)	
	Conserved	Non-conserved	Conserved	Non-conserved
Namunyak	1.18 (±1.04)*	9.32 (±1.60)*	0.02 (±0.711)†	5.83 (±1.55) †
Sera	2.96 (±1.33)	3.92 (±1.90)	2.54 (±1.21)	1.90 (±1.04)
West Gate	4.52 (±1.76)	3.78 (±0.94)	4.38 (±1.65)	2.52 (±0.88)

*Differences are significant: U=3351.5, z=5.42 p<0.01. †Differences are significant: U=3461.0, z=-4.33 p<0.01

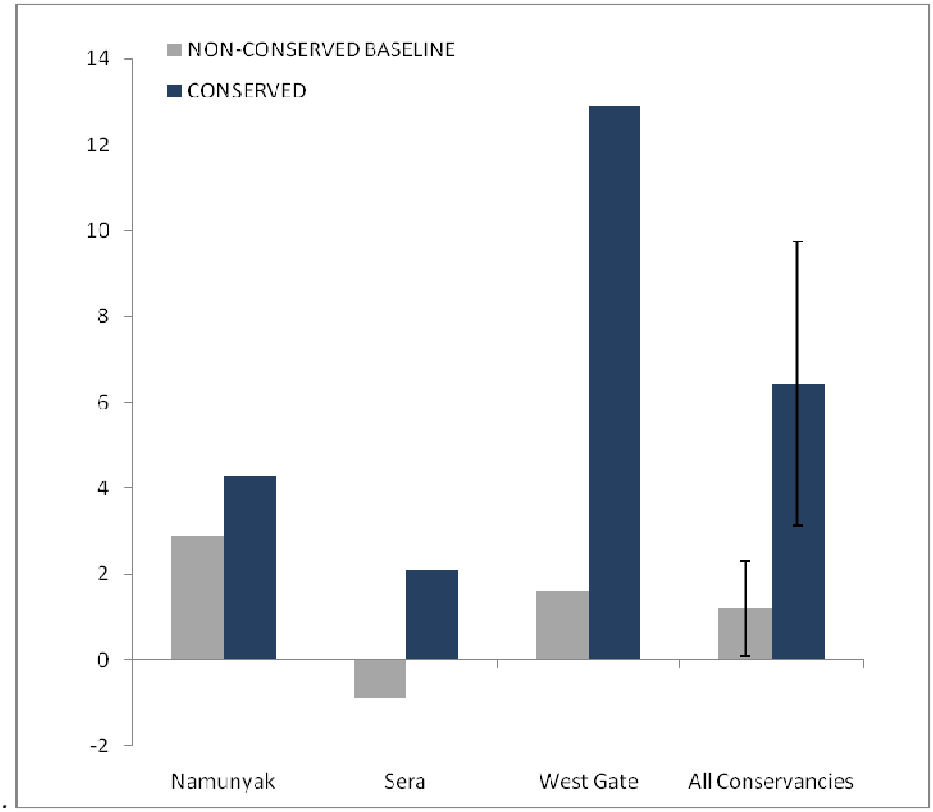
Trends in paid employment as an income component

Opportunities for paid employment in northern Kenya are limited, particularly in small, rural communities (Little et al., 2007). The establishment of community institutions to provide conservation and development benefits has led to a number of new jobs being created in the region. In all conservancies, a change in the proportion of households deriving income from employment has increased at a higher rate than the matched comparison sites (Figure 4.5). As the number of positions created has been relatively small compared to the total number of households in the region, it is unsurprising that these trends, whilst visible, are not statistically significant (Z= -1.60, n.s.). In West Gate which has the smallest population relative to the number of conservancy staff, significant changes have however occurred in the median proportion of household income linked to employment relative to the matched non-conservancy baseline (U=2419.0, z=-4.59, p<0.01).

Trends in alternative livelihoods as an income component

The provision of alternative livelihoods in conservancy communities through the marketing of handicrafts produced by women's groups has been led by NRT in a number of conservancies. While the impact of this initiative is apparent in the conservancies (see section 4.2.4), there are no significant changes in the percentage of households generating their income from crafts or in the proportion of household income derived from this activity ($Mdn_{(NRT)}$ = 0.0± SIQR 0.0, $Mdn_{(MCS)}$ =0.0± SIQR 0.0, U=37911.0, z=-0.17, ns).

Figure 4.5. Change in the percentage of households deriving income from employment in conserved and non-conserved areas.



Trends in income composition

Incomes in conservancy communities have been more stable than in their non-conserved counterparts, particularly amongst low-income households both in terms of overall trend (section 4.2.2).

Less than half of the livelihoods components studied have undergone substantial change in conserved areas when compared to their non-conserved counterparts (Table 4.7). Across all communities in the region, the contribution of livestock and food relief have undergone substantial change during the study period (section 4.2.2). Livestock declines may be linked to repeated, and at times, severe drought, increasing reliance on emergency relief assistance.

Poorer non-conservancy communities have significantly increased their reliance on wild resources and non-livestock activities. During the dry season, their reliance on emergency food relief, bee-keeping and the collection of wild fruits has increased at a higher rate than in the same socioeconomic group in the conservancies (Relief $U=12859.0$, $z=-2.29$,$p<0.05$; Bee-keeping $U=13856.0$, $z=-2.23$, $p<0.05$; Wild fruits $U=12936.0$, $z=-3.26$, $p<0.01$). Similarly middle-income households in these areas have switched away from livestock production supplementing their income with by opening small businesses or relying on charcoal production (Small business $U=2134.0$, $z=-2.99$, $p<0.01$; Charcoal production $U=215.0$, $z=-2.89$, $p<0.01$). These

trends suggest the viability of traditional income generation through pastoralism has declined outside the conservancies, except for the wealthiest households who have maintained their dependence on livestock compared to significant declines (-10%) similarly wealthy households in the conservancies (U=198.0, z=-2.46, p<0.05).

Table 4.7 Change in livelihoods income components in conserved and non-conserved areas.

Income Component	Percentage change in the proportion of income derived from activity			
	Dry Season		Rainy Season	
	Conserved	Non-Conserved	Conserved	Non-conserved
Charcoal production	0.81 (6.39)†	0.59 (2.54) †	0.36 (4.44)†	0.5 (2.49)†
Honey	-0.24 (3.58)	0.24 (2.23)	-0.11 (2.58)	-0.06 (2.11)
Livestock	-8.3 (18.50)	-9.77 (17.67)	-7.53 (16.95)	-6.78 (17.84)
Paid employment	2.03 (9.74)*	0.28 (2.59)*	1.71 (8.6)*	0.55 (4.99)*
Relief assistance	2.68 (13.05)†	5.58 (12.86) †	2.04 (11.30) †	3.35 (11.74)†
Remittance from a family member	1.07 (7.49)	0.53 (6.06)	* 0.92 (6.47)	0.54 (3.1)*
Small business	*0.78 (6.57)	0.81 (3.29)*	0.66 (5.5)	0.45 (2.23)
Traditional crafts	1.01 (7.09)	0.22 (1.10)	1.09 (5.60)	0.08 (0.46)
Wild resource collection	-0.11 (4.02)†	0.23 (5.74) †	0.34 (3.75)†	† 0.53 (3.1) †

*Significant at p<0.05 † Significant at p<0.01

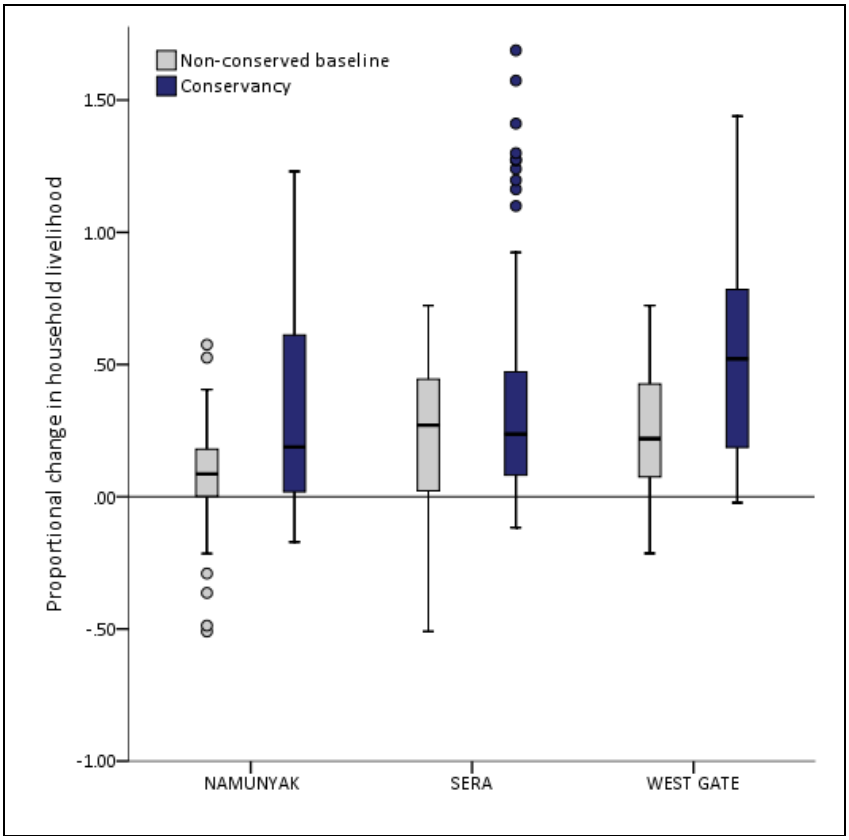
4.2.3 Livelihoods outcomes analysis

In northern Kenya, conservancy communities have experienced significantly greater improvements in livelihood compared to equivalent non-participating communities at both the household ($Mdn_{(NRT)}$ = 0.26± SIQR 0.31, $Mdn_{(MCS)}$ =0.17± SIQR 0.17, U=35437.0, z=-5.65, p<0.01) and village levels ($Mdn_{(NRT)}$ =0.28± SIQR 0.32, $Mdn_{(MCS)}$ =0.17 ± SIQR 0.14, U=33934.0, z=-6.32, p<0.01). This trend is also apparent in two conservancies, Namunyak ($Mdn_{(NRT)}$ =0.19± SIQR 0.22, $Mdn_{(MCS)}$ =0.09± SIQR 0.09, U=4122.0, z=-5.01, p<0.01) and West Gate ($Mdn_{(NRT)}$ = 0.52± SIQR 0.60, $Mdn_{(MCS)}$ =0.22± SIQR 0.18, U=2390.5, z=-4.33, p<0.01) when considered independently. In the case of Sera, the conservancy community has undergone similar median rates of change ($Mdn_{(NRT)}$ = 0.24± SIQR 0.20) as equivalent communities in the wider landscape ($Mdn_{(MCS)}$ =0.27± SIQR 0.21, U=5448.0, z=-0.40, ns). Reported proportional change in livelihood is, however skewed positively in Sera's communities (Figure 4.6). This is in contrast to the negative skew apparent in the matched comparison communities for the site and could be indicative of emerging livelihoods changes in a small number of households in the conservancy.

Within the conservancies, perceived livelihoods benefits are not distributed equally. A generalized linear model (Gaussian distribution with an identity link) was used to model the relationship between the

proportional change in livelihood perceived by a household and the socioeconomic and demographic characteristics of that household (Table 4.8).

Figure 4.6 Proportional change in livelihoods in Northern Rangelands Trust conservancies and non-conserved baseline areas over the period of conservancy establishment.



Gender and ethnicity were significant demographic predictors of livelihood benefit, with men and those from minority groups more likely to report higher proportional change in livelihood due to the conservancies. Unsurprisingly, group ranch membership was also a significant factor in households' perception of change. The group ranch is a collective land tenure designation in which registered households are recognised as having legal rights to the land. Where the designation is in place (as in Namunyak and West Gate), it is the Group Ranch members who elect the Conservancy Trustees and receive direct financial benefits from conservation.

Socioeconomic status was also an important predictor of livelihood change. Households with little or no dependence on relief food, and those with stable or high incomes were more likely to report greater benefit to their livelihood as a result of conservation. Interestingly, middle-income households were less likely to report such change than their poorer or wealthier counterparts in the community.

Table 4.8. Generalized linear model of the proportional change in household income within Northern Rangelands Trust conservancies since conservancy establishment.

Variable		B (Std. Error)	95% Wald Confidence Interval		
			Lower	Odds Ratio	Upper
(Intercept)		-0.15 (0.32)	0.98	1.21	1.51
Gender*	(Male)	0.21 (0.04)	1.13	1.22	1.33
	(Female)	0		1	
Ethnicity*	(Samburu)	-0.22 (0.05)	0.73	0.8	0.88
	(Akamba)	-0.40 (0.03)	0.63	0.67	0.72
	(Somali)	0.91 (0.07)	2.47	2.45	2.86
	(Turkana)	0		1	
Relief dependency*	(Not an income component)	0.88 (0.08)	2.07	2.43	2.86
	(Minor income component)	0.75 (0.06)	1.89	2.12	2.38
	(Primary Income)	0		1	
Income trend*	('Declining')	-0.29 (0.08)	0.64	0.74	0.88
	('Stable')	-0.37 (0.07)	0.61	0.69	0.80
	('Increasing')	0		1	
Group Ranch membership*	(Non-member)	-0.20 (0.04)	0.75	0.82	0.88
	(Member)	0		1	
Wealth stratum*	High income households	0.01 (0.05)	0.90	1.003	1.12
	Middle income households	-0.15 (0.06)	0.77	0.86	0.97
	Low income households	0		1	

Likelihood ratio χ^2_{29}= 102.88, p<0.01; *p<0.01; Pseudo R^2= 0.73 (after Zheng & Agresti, 2000).

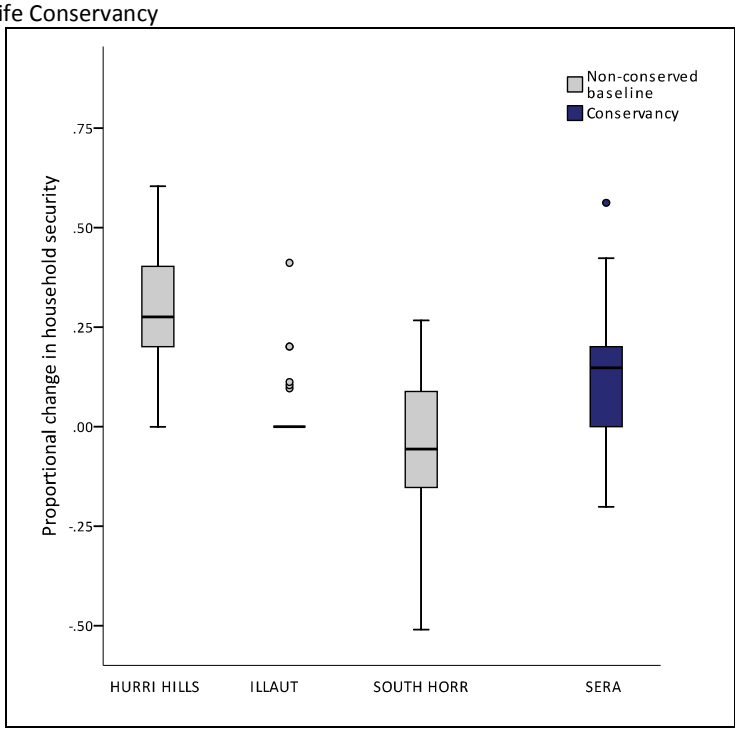
4.2.4 Livelihood Security

Greater proportional change in livelihood security occurred in conservancies (Mdn $_{(NRT)}$ =0.13± SIQR 0.04) than in non-conservancy communities (Mdn $_{(MCS)}$ =0.00± SIQR 0.12) over the time periods studied (U=45144.0, z=-2.361, p<0.05). When considered separately, it is only Namunyak the oldest conservancy, where this relationship remains significant (Mdn $_{(NRT)}$ =0.09± SIQR 0.00, Mdn $_{(MCS)}$ =0.0± SIQR 0.03, U=3278.5, z=-7.45, p<0.01). Elsewhere, non-conserved sites have experienced greater increases in livelihood security than their matched conservancies. This trend may, however, be due more to events in one of the comparison sites, matched to both Sera and West Gate conservancies. Hurri Hills is a sub-location close to the Ethiopian border, whose multicultural community is both agrarian and pastoralist (Munyao & Barrett, 2005). From the late 1990s until the mid 2000s, natural resource conflict fuelled by ethnic tensions caused substantial security problems in the area (Munyao & Barrett, 2005). Since then and concurrent with improvements to physical security due to NRT further south (CDC et al., 2009), violence has declined (Munyao & Barrett, 2005). As a consequence, respondents from Hurri Hills report much higher improvements to their security than other matched

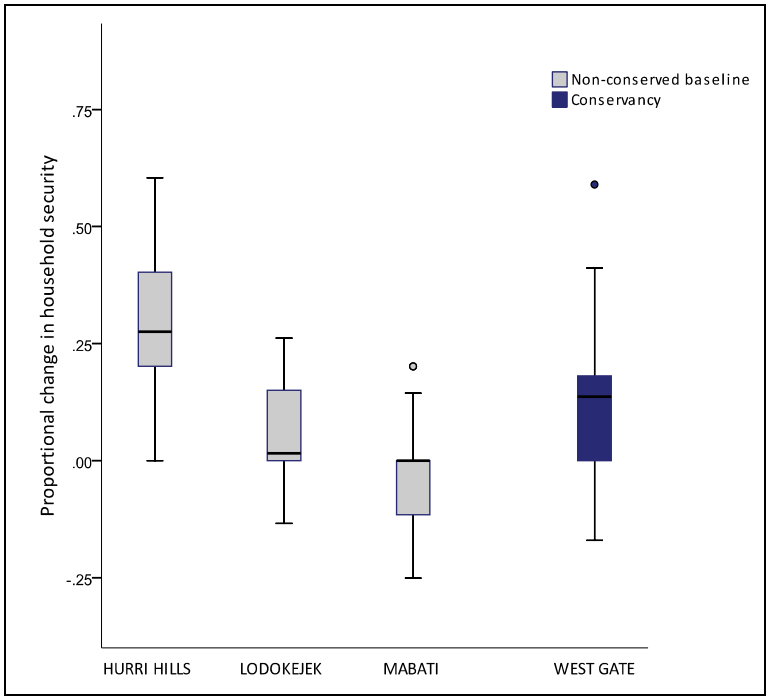
comparison communities (Figure 4.7), driving the overall non-conserved medians upward. This may be masking the security impact of conservation in Sera and West Gate.

Figure 4.7 Proportional changes in livelihood security in a) Sera Wildlife Conservancy and b) West Gate Community Conservancy in relation to their respective matched comparison sites.

a) Sera Wildlife Conservancy



b) West Gate Community Conservancy



Trends in Human Wildlife Conflict

In Namunyak, conservancy communities report a significant amelioration in this conflict in comparison to equivalent non-conserving communities (Mdn $_{(NRT)}$ = 0.0± SIQR 0.0, Mdn $_{(MCS)}$ = 0.0 ± SIQR 0.0, U=6422.5, z=-2.104, p<0.05). Across all communities respondents typically perceived conflict with wildlife to be '*part of normal life'*. However while contact with some species was tolerated, others were seen as vermin. One elderly respondent living in Lkisin, Namunyak, explained that because '….*elephants and cows have grazed together since I was born'*, he did not see their presence as a problem. However, he wanted Namunyak's help, '*…to get rid of …the hyena that kills livestock.'*

The significant decline in human-wildlife conflict in Namunyak contrasts with the situation in Sera Wildlife Conservancy and West Gate, where conflict has increased at a similar rate to their matched comparison sites (Sera: Mdn $_{(NRT)}$= 0.0± SIQR 0.0, Mdn $_{(MCS)}$ = 0.0 ± SIQR 0.0, U=5704.0, z=-0.797, n.s.; West Gate: Mdn $_{(NRT)}$= 0.0± SIQR 0.0, Mdn $_{(MCS)}$ = 0.0 ± SIQR 0.0, U=3903.5, z=-1.56, n.s.)

Sera occupies a region on the border between communities dominated by the Samburu tribe and those where Boran form the majority. Since the mid-1960s, much of the present-day conservancy core and buffer zone were a 'no man's land' between the two tribes, who were in conflict over access to resources. As a result, the population in the region was low and the community seldom came into contact with wildlife as livestock grazing was limited by the conflict. Commercial and subsistence poaching was common; '*Before there were very few people living in the area and the wildlife were just being killed and eaten every day.'* Since conservancy establishment, the security situation in the region has improved, enabling grazing and settlement over a larger area, '*There is security, now we are living in this area'.* This potentially brings livestock into more frequent contact with wildlife.

West Gate is immediately adjacent to Samburu National Reserve, and its western boundary which follows the Ewaso Nyiro River may act as a dispersal corridor for a number of large mammals, including African Elephant (Douglas-Hamilton et al., 2005). Consequently, encounters between domestic livestock and wildlife are frequent and the potential for conflict high, resulting in comparable trends in conserved and non-conserved areas.

Trends in Physical Security

Improvements in the physical security of communities were perceived to be the most important impacts of conservancy establishment in Sera and West Gate in household interviews (Table 4.9), while in Namunyak the decline in insecurity was second only to transportation benefits in importance (Table 4.9). Across the three conservancies, 63% of respondents reported their households were safer than prior to conservancy establishment, compared to 54% of non-conservancy households.

Table 4.9 Ranked socioeconomic impacts of community conservation. Impacts are ranked in order of median percentage change at both the household and community levels. * Change significantly higher in conservancy p<0.01, ‡ Change significantly higher in conservancy p<0.05, † Change significantly higher in matched comparison sites p<0.01.

a) NAMUNYAK

Household level	Community level
Access to affordable transport*	Access to affordable transport*
Security*	Security*
Access to timber*	Access to secondary education*
Access to secondary education*	Access to affordable medical care*
Access to affordable medical care*	Access to timber*
Access to drinking water†	Access to drinking water†
Quality of grazing resource*	Access to paid employment*
Access to paid employment‡	Quality of grazing resource*
Access to water for livestock†	Access to water for livestock†

b) SERA

Household level	Community level
Security‡	Security
Access to affordable transport*	Access to affordable transport*
Access to timber resources*	Access to paid employment*
Access to secondary education*	Access to timber resources*
Access to livestock markets	Access to secondary education*
Access to drinking water†	Support from non-governmental organisations
Availability of grazing resources*	Access to livestock markets
Access to primary education†	Access to drinking water†
Access to paid employment	Access to primary education†

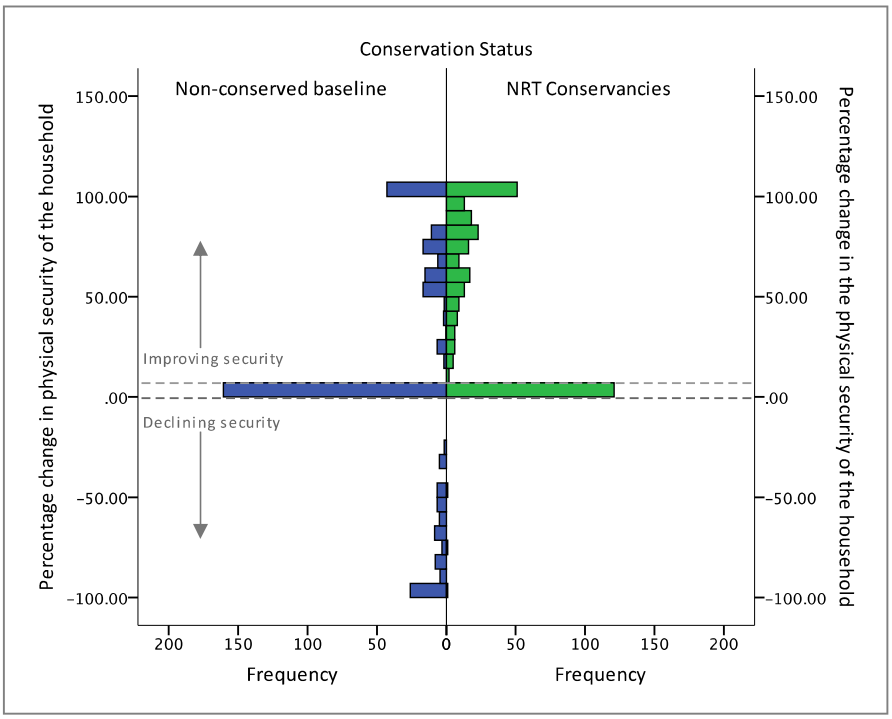
.

c) WEST GATE

Household level	Community level
Security‡	Security‡
Access to timber resources*	Employment*
Access to affordable transport*	Access to affordable transport*
Quality of grazing resource*	Access to timber resources*
Availability of grazing resources*	Support from non-governmental organisations
Access to secondary level education*	Access to secondary level education*
Access to drinking water†	Quality of grazing resource*
Access to primary education†	Availability of grazing resources*
Support from non-governmental organisations	Access to drinking water†

21% of households in the latter communities reported that the security situation had deteriorated during the study period, compared to less than 1% of participating households (Figure 4.7). As discussed in the preceding section, concurrent changes in Hurri Hills mask the physical security impact in Sera ($Mdn_{(NRT)}$= 46.5 ± SIQR 38.4, $Mdn_{(MCS)}$=75.5 ± SIQR 50.0, U= 4918.5, z=-2.18, p<0.05) whereas in West Gate ($Mdn_{(NRT)}$= 63.6 ± SIQR 43.4, $Mdn_{(MCS)}$=0.0 ± SIQR 37.7, U= 3093.5, z=-0.156, p<0.05) and Namunyak, the trend is significant ($Mdn_{(NRT)}$= 4.5 ± SIQR 31.9, $Mdn_{(MCS)}$=0.0 ± SIQR 0.0, U= 2682.0, z=-9.032, p<0.01).

Figure 4.8 Frequency of respondents reported change to the physical security of their households in communities participating in Northern Rangelands Trust conservancies and those outside of this network.



Differences between communities were significant ($Mdn_{(NRT)}$ = 49.6 ± 18.4, $Mdn_{(MCS)}$ =0.0 ± 30.8, U= 34502.5, z=-7.12, p<0.01)

Improvements to physical security were similarly prominent in focus group discussions (Table 4.10), particularly in Sera where one respondent explained the contrasting security situations before and after conservancy establishment:

> *"It was bad, because the bandits would come and we would fight them. Then they would go and nobody was around this area. A group of families were just around the police station. During those days, you really slept with your shoes on your feet. But now, we have Sera Conservancy, now we are free to move and our animals are free to go anywhere in those areas and that's the goodness that we have seen."*

Community members also explained that improvements to their physical security have had wider implications for their livelihood. In West Gate, the elders observed, '*Where there is no peace, no security, there is no development. So security is the most important thing*'. This was echoed by one female respondent in Sera, who commented that *'if there is no security, there is nothing that will go on, so that's the first thing.'*

Radio communication is critical to the provision of security, and as one NRT staff member explains, may have a role in encouraging trust and co-operation between different ethnic groups and stakeholders in the region:

> *'We have all the conservancies with a two-way radio system, everybody talking the same language, so there's* [sic.] *no secrets. So in a situation with no secrets, in case an incident happens right now, it's on air across everywhere. Everyone will be aware…..we have linked Kenya Wildlife Service…and the Government through the Kenya Police, so right now they can hear, really. So if some goats are stolen today, everyone can hear, everyone is aware and everyone can head in that direction and help. '*

While improvements have been made, both community members and NRT staff, identify that a security challenge has remained, '*We cannot say that it has ceased completely, but at least it has really reduced*." (Elder in Sere-olipi, Sera Wildlife Conservancy).

4.2.5 Trends in Empowerment

Households living in conservancy communities ($Mdn_{(NRT)}$ =0.0± SIQR 0.5) report significantly higher increases in empowerment (U=30810.0, z=-11.64, p<0.01) than their counterparts who do not participate in community conservation ($Mdn_{(MCS)}$ =0.0± SIQR 0.0). In the latter communities, none of the surveyed households reported any increase in empowerment which measured as the level of householder participation in village decision making.

Empowerment in the form of knowledge, the ability to govern resources and gender equity was a consistent theme of focus group discussions in the three conservancies. In Sera, respondents focused on having their own conservancy institution, rather than relying on the resources of neighbouring Namunyak. In the latter, community members emphasised the knowledge gained both from *'…..taking us for outside trips, to understand about these conservancies.'* (Resident of Lkisin, Namunyak) as well as from seminars on specific topics:

> *'We were taught about how to care of the grazing, how to use the grass during the rainy season and how to the use the grass in the dry season. So now it is good because now we know how to control grazing in our area and our hills…. I was given a very big torch for applying that idea and those rules here.'*
>
> (Elder from Namunyak).

Table 4.10 Socioeconomic outcomes of NRT conservancies, ranked in order of importance by focus group participants.

a) NAMUNYAK

WOMEN	YOUTH	ELDERS
Education bursaries	Education bursaries	Peace
Development funds	Purchase of livestock for poor	Protecting wildlife
Medical care	Security	Security from road banditry
Security		Education bursaries
Knowledge and seminars		Communication
		Medical fund
		Development funds
		Seminars

b) SERA

WOMEN	YOUTH	ELDERS
Security	Security	Security
Medical care	Transport to hospital	Roads/Communication
Importance of wildlife		Development funds
Education bursaries		Reduced conflict with Boran
Transport		Employment
Employment		Medical care
Reduced human wildlife conflict		Alternative livelihood: beads.
Empowerment		
Alternative livelihoods		

c) WEST GATE

WOMEN	YOUTH	ELDERS
Paid employment	Water	Security
Employment of female scouts	Access to a dispensary	Water
Alternative livelihoods: NRT	Sponsors	Paid employment
Trading		
Sponsors	Bursaries	Education
Bursaries	Paid employment	Women's employment
Medical fund	Grazing management	Grazing management

In West Gate, the empowerment of women was an important livelihood outcome for both genders. For the women themselves, the employment of female scouts and the provision of alternative livelihoods through NRT Trading were highlighted as important socioeconomic impacts of the conservancy. These female empowerment outcomes were security only to improved physical security in importance. Surprisingly, this view was largely shared by the *wazee,* who recognised the importance of employment for women as a separate benefit to the provision of paid employment in the community. Indeed, recognising the limited opportunities for unmarried Samburu women, one of the elders in Ngutuk Ongiron concluded that '*…it is hard to find a man without a wife, but it is often that you can find a woman without a husband. So, it is good that there are more chances for women*'.

Institutional governance

Equity issues do, however, remain in relation to the management and governance of the conservancies. In all conservancies, *morans* are largely excluded from management, an exclusion which stems from cultural tradition. '*The morans in our culture are a group apart. They are not for these conservancy meetings*' (Moran, Ngutuk Ongiron, West Gate Community Conservancy). As a consequence, morans perceive that conservancies bring them limited benefit and place them in conflict with others in the community:

> '*It's not good that they hold meetings without calling us because sometimes they will go and make a decision that we do not agree with. So it is not good because then we have some fight* [sic.]. *It is we that are the front-line, we are part of the community and we should be involved in this thing.*'
>
> (Moran, Sere-Olipi, Sera Wildlife Conservancy)

Indeed, in Sera morans largely refused to participate in focus group discussions stating that as they were not involved in management and therefore could not perceive benefits from the conservancy. In all three conservancies, *morans* requested further involvement in conservancy management, '*…we want a representative so that where there is a meeting, they can go there and keep us informed*'. The apparent failure of the conservancies to adequately engage with the warrior class has implications for grazing management and physical security as *morans* have an important role in both of these issues (Spencer, 2004).

The women of Namunyak reported similar exclusions stating that '*…we don't have a voice. What the men say, that's what they'll do. It's men that have got this voice*'. They requested greater inclusion of women in the decision-making process, with an increased number of female Trustees on the Namunyak Board. Elsewhere, women were happy with their role in conservancy management, and the unhappiness with Namunyak's decision-making process amongst the communities' women is symptomatic not of a gender equity issues but of a wider governance problem.

Across Namunyak, community members expressed concern at the current management structure. These focused on the allocation mechanism for the bursaries. '[*T*]*here is a slight problem because the children who had the bursary allocated to them, instead of that child benefitting a different child benefits'* (Elder, Namunyak Wildlife Conservancy). It is important to note that since this issue first emerged in June 2009, steps have been taken to address accountability and a new Board of Trustees has been elected. The community had relatively little knowledge of either the decisions made by management or the management itself. One respondent addressed researchers saying '*apart from you….no-one here knew there was a community manager.*' Community members were, however careful to make clear that while they had concerns about the governance of the conservancy, they were seeing the benefits of its existence:

> *'I want to stress this. Although Namunyak is trying, we want Namunyak to excel. We want transparency and accountability in management.'*
>
> (Elder, Namunyak Wildlife Conservancy)

4.2.6 Trends in Assets and Opportunities

A sustainable livelihood requires access to a range of human and infrastructural assets which can be used to support income generating activities. This includes the availability and quality of natural resource flows as well as access to education, transportation, material goods (typically through access to monetary resources) and the potential to derive income from alternative sources. In northern Kenya, non-conservancy areas have undergone higher rates of change in opportunities ($Mdn_{(MCS)}$ =0.16± SIQR 0.07) than communities in conserved areas ($Mdn_{(NRT)}$ =0.06± SIQR 0.05, U=38489.5, z=-5.21, $p<0.01$). However, this overall index of assets and opportunities conceals substantial variation, both between individual indicators and individual conservancies.

Trends in access to financial resources

Access to financial resources is limited in northern Kenya. The economy remains largely subsistence-based with few households generating income from salaried employment. Instead the majority engage in either small-scale enterprise or the sale of livestock to generate cash resources. Since conservancy establishment, participating communities have reported an increase in access to employment at both the household and community levels. '*Before the conservancy, people would go to Nairobi, hunting for jobs in Nairobi. But right now we are seeing that there are jobs, employment here'* (Moran, West Gate Conservancy). Importantly, many of the employment opportunities offered by the conservancies and allied organisations are accessible to community members who either did not attend school or did not complete their education. As one of the women in Sera remarked, '*Before, we had that mentality, that if you were not educated you could not get a job. But now there are boys who are not completely educated that are working as security at Sera. So Sera really has helped, because it has provided for them'*.

While at the individual household level these increases are not significant compared to non-participating communities, the change is significant at the community level in both Sera and West Gate conservancies (Table 4.11 and Figure 4.9). The discrepancy between direct benefits to the household and the benefits accruing to the wider community, suggests that respondents recognise that increased employment within the community at large is also beneficial, albeit indirectly, to their own livelihoods. This perception was equally likely across the different demographic and economic groups within the community. Respondents in Sera and West Gate identified two mechanisms by which increased employment can be indirectly beneficial to the community at large. Firstly, those living in close proximity to a Conservancy employee benefit through monetary gifts and loans meaning that '*….at least they don't miss to have KSh 50* [US $0.6]*, so they don't miss sugar and those things.'* The increasing number of salaried households in the community also has a second, wider benefit identified by one of the elders in Sere-Olipi: '*The bringing of money to this area… this centre* [Sere-Olipi Town] *is doing well. It is now picking up because of this money. '*

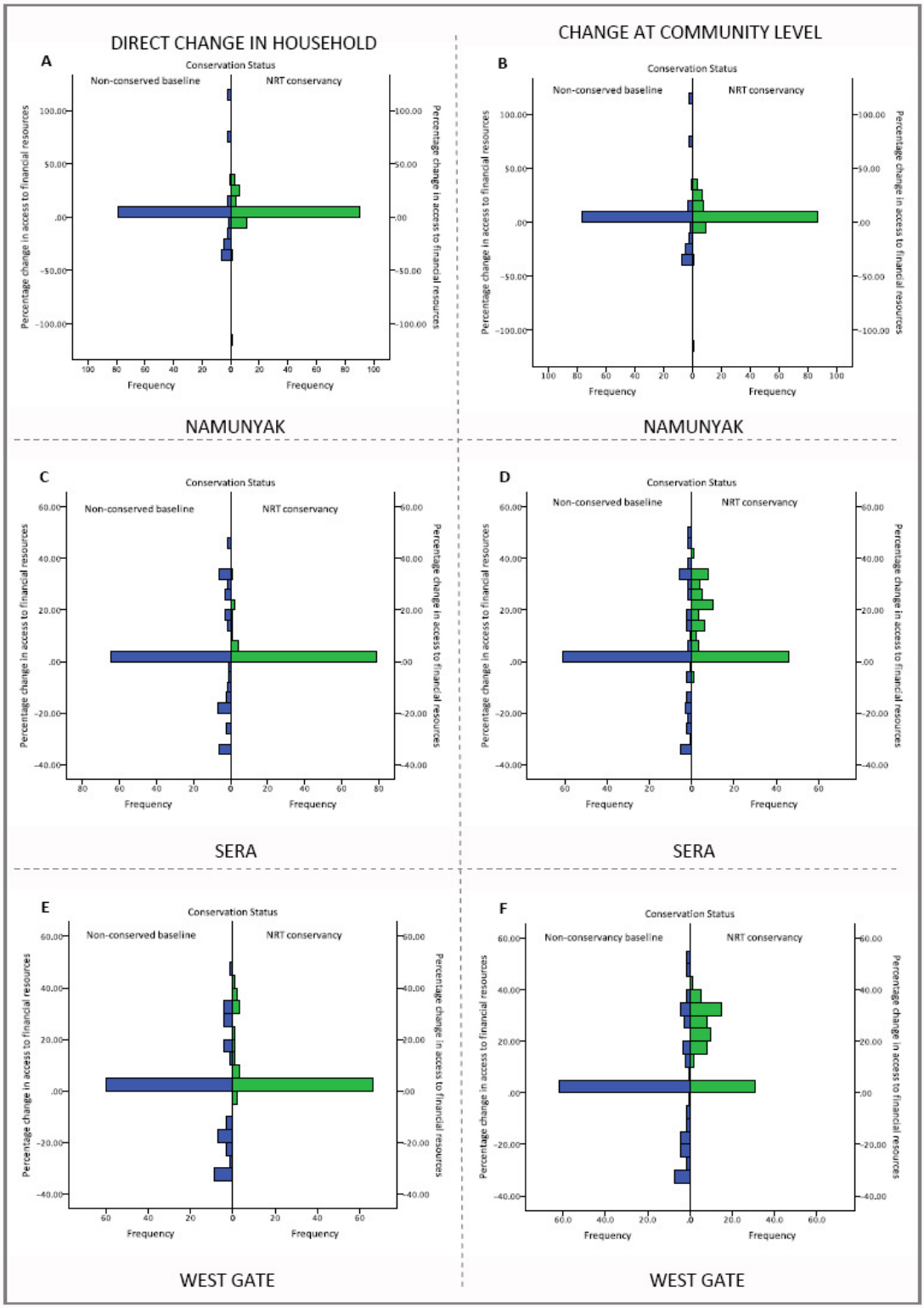
Table 4.11 Trends in financial resources in Northern Rangelands Trust conservancies compared to non-conserved baseline sites.

Site	Access to financial resources at the household level	Access to financial resources at the community level
Namunyak	$Mdn_{(NRT)}$=0.0±0.7 $Mdn_{(MCS)}$=0.0±0.5 U=5635.5 z=-0.51,n.s	$Mdn_{(NRT)}$=0.0±0.9 $Mdn_{(MCS)}$=0.0±0.5 U=5388.0 z=-1.07, n.s.
Sera	$Mdn_{(NRT)}$=0.0±0.0 $Mdn_{(MCS)}$ =0.0±0. U=4154.0, z=-1.62,n.s	$Mdn_{(NRT)}$=0.0±10.9 $Mdn_{(MCS)}$=0.0±0.1 U=3316.5, z=-3.7,p<0.01
West Gate	$Mdn_{(NRT)}$=0.0±1.0 $Mdn_{(MCS)}$=0.0±0.3 U=2336.5, z=-1.65, n.s	$Mdn_{(NRT)}$=18.6±15.0 $Mdn_{(MCS)}$=0.0±0.5 U=1438.0, z=-5.08, p<0.01

Trends in alternative livelihoods.

There were no significant differences in the uptake of alternative livelihoods between conserved ($Mdn_{(NRT)}$ =0.00 ± SIQR 0.00) and non-conserved areas ($Mdn_{(MCS)}$ = 0.00 ± SIQR 0.00; U=37792.5, n.s). Alternative livelihoods were those which do not rely upon livestock and which had been the focus of NRT initiatives, such as the manufacture of traditional beads and crafts. The lack of statistical significance may be due to the relatively small scale of this initiative, both in terms of the number of participating households, and the level of income it brings in comparison to livestock husbandry.

Figure 4.9 Trends in access to financial resources at the household and community levels in conserving and non-conserving communities of northern Kenya.



The absence of statistically significant differences in alternative livelihood uptake in conserved and non-conserved communities is at odds with the qualitative evaluation of community members themselves. In Sera and West Gate, both women and elders identified NRT Trading as an important socioeconomic benefit of conservancy establishment. This is particularly the case for the women of West Gate, who placed the alternative income generated through NRT Trading as second only to employment benefits in terms of importance to their livelihood.

One woman in Ngutuk Ongiron remarked that '*we are the women that really love Celina* [Enterprise and Product Development Manager, NRT]*'.* While the income generated through NRT Trading is relatively small, '*…sometimes it's KSh 1,000* [US$12.50]*. Sometimes it's KSh 700* [US$8.70]*; it depends on the order…'* but it remains a useful because it provides community members with access to cash resources without having to sell livestock. As one elder in Sera remarked, '*It gives us money so that we can buy food and clothes'.*

In addition to marketing beads and local crafts, NRT Trading provides micro-credit to community members, particularly women so that *'[s]omeone could open a shop selling foodstuffs, then others will buy some goats and sell them for a higher price.'*

However, NRT Trading initiative has not been uniformly beneficial, particularly in Sera, where there is animosity amongst some community members toward the project. This stems from a mismatch between community expectation and the benefit realised to date. There is conflict between community members and the programme on both the price and quality of items. Where items do not meet the quality control standards of the programme, they are rejected. One elder is Sera explained the consequences for women in the community: '*The little money that they have to buy the children food, they say 'No!'. They buy beads…instead so that they will have big money later. But then, they get nothing*. *'Similarly* the women of Sere-Olipi complained that prices were lower than they could obtain from Sarara, a nearby lodge '*...and beads that they were buying at KSh100* [US$1.20]*, we will take to Sarara and they will buy at KSh500* [US$ 6.20]*'.* The conflict in Sera and its marked absence from West Gate suggests that the success of programme implemented may be highly context dependent.

Accessing public services: the barriers of awareness, infrastructure and affordability

There are clear differences in the construction of infrastructure and service affordability trends between conserved and equivalent non-conserved areas.

The increase in physical infrastructure for the provision of water, sanitation, health care and transport has been much greater outside of conserved areas than in conservancy communities (Table 4.12). Similarly awareness of both medical issues and available treatments, including those for livestock, is perceived as a major change by households outside of the NRT conservancy network, but is rarely mentioned by respondents

Table 4.12. Percentage change in access to medical care and affordable transportation in Northern Rangelands Trust conservancies and matched non-conservancy communities.

Opportunity	Indicator	Median percentage change in livelihood indicator (SIQR)	
		Conserved	Non-conserved
Access to medical care	Awareness of the importance of medical care*	0.0 ± 0.0	0.0 ± 0.0
	Access to a clinic or medical professional†	0.0 ± 0.0	0.0 ± 20.0
	Affordability of medical care‡	0.0 ± 0.0	0.0 ± 0.0
Access to transportation	Availability of roads§	0.0 ± 0.0	0.0 ± 14.0
	Access to affordable means of transportation¤	52.0 ± 17.7	0.0 ± 0.0

*U= 38325.5, z=-8.2, p<0.01. †U=32449.5, z=-8.6, p<0.01. ‡U=4112.0, z=-8.9, p<0.01. § U=34084.0, z=-10.1, p<0.01. ¤ U= 43674.0, z=-5.28, p<0.01.

in participating communities. Significant improvements were apparent in conservancy communities when the affordability of services was considered. The ability of households to access affordable medical care and affordable transportation has undergone increased in conservancy communities while in matched non-conserved areas, medical care has become increasingly expensive for households (Table 4.12). This stems from the set-aside of community funds derived from wildlife-linked enterprises to pay for the medical treatment and the provision of vehicles to assist in anti-poaching patrols respectively. In the case of the latter, community members are offered free lifts at the road-side where this coincides with the vehicle's route and they may also request assistance in medical emergencies.

From the data presented in Table 4.12, it could be concluded that conservancies have had little impact on the awareness of, or physical access to, medical care or transportation. However, such an interpretation assumes that the different aspects of service provision are reported equally by respondents and that community perceptions of change do not shift over time. Neither of these conditions is supported by the scientific literature or experience on the ground.

Increasing opportunities and assets may be seen as the sequential removal of barriers which inhibit a household's ability to use a particular service (Ellis & Biggs, 2001). In the case of medical care, this may be raising awareness about the treatments available for specific illnesses, constructing a clinic or employing a doctor, together with enabling households to afford consultation fees or medicines. Households participating in a conservancy were more likely to report the impact of medical bursaries derived from biodiversity-linked enterprise than to discuss the construction of clinics or awareness programmes. This may represent the most recent step in the gradual removal of barriers to adequate medical care. The preceding changes in awareness and provision of infrastructure may be implicitly assumed by respondents, who perceive concerns about the affordability of medical care would necessitate knowledge of its importance and the presence of adequate infrastructure. Such a sequential relationship in drivers of human need has been described by Maslow, 1943)

who argued that once a need has been satisfied the perceived baseline of requirements may shift to the next step in the hierarchy.

Similarly, the time elapsed between initiatives and interview may also be an important factor, with respondents more likely to recall more recent events. If the provision of infrastructure occurred prior to the medical bursary in a community, households are likely to report only the most recent changes. For example, in a study of waste recycling behaviour in the U.K, (Timlett & Williams, 2008) reported that unless regular feedback was provided to households on the services available to them, recall declined. Indeed, the danger of long-standing benefits derived from the conservancies being overlooked by community members without feedback was highlight by one key informant, who remarked '*Give it three or four years and…[it] is forgotten, it starts to fade in their memory; and that's the challenge for conservation in general, to keep that momentum going'.* Consequently, it may be appropriate to view the significant increase in the affordability of services within the conservancies as the most recent, but not the only, phase in improved opportunity components of livelihood which has emerged as a result of NRT.

Trends in educational provision

Across all three conservancies, access to secondary education has become significantly easier for participating communities when compared to changes in access levels outside the NRT network (Figure 4.10). 29% of respondents living in Namunyak's communities reported that the bursary had directly improved access to secondary education for members of their own households, while more than half (52.1%) reported that access had improved for the community as a whole.

Improving access to education has been one of the focal areas for the community funding in the conservancies. This is particularly the case in the Namunyak, where bursaries to assist in the payment of secondary and higher education fees are the most important direct financial benefit for households (Table 4.9). The amount given as a bursary is variable, but respondents typically reported a value between KSh 1,000 to KSh 3,000 (US$ 12-36One of the *morans* in West Gate explained the importance of this change for his community:

> *'Before when we have bright children who want to go forward to secondary School, if their families don't have money, don't help that child to continue with their education, that child will just come home and just go like that, without School. But right now, if you don't have anything in your family, you can just go to the Conservancy for the bursary and that child will continue on.'*

Similar impacts were not apparent in access to primary education. 36.8% of respondents in non-conservancy communities reporting improvements in their household's ability to educate children at the primary level. In contrast, only 7.8% the respondents in conservancy areas did so ($U=343.56$, $z=-9.21$, $p<0.01$).

Firstly, the Government of Kenya introduced free primary education in 2003, making access to the first stage of education universal (Oketch & Rolleston, 2007). Outside of the conservancies, 36.8% respondents reported this change. In contrast, only 7.8% the respondents in conservancy areas did so. As a result of the Government programme, direct initiatives led by the conservancies were no longer required for primary education. In some areas, such as West Gate, community funds were shifted to enhance pre-school education provision. '*The conservancy is trying to build some pre-Schools and they providing the children with books, with pens and pencils and with shoes. They are also providing the children with food so that when they come to School they can have food. They are paying the pre-School teachers*' (Elder, West Gate Community Conservancy). Typically, however, communities in the conservancies chose to focus their efforts in improving access to secondary and University level education as well as supporting mock examinations and '*…meeting students at the end of year to talk about careers, performances, trying to push students…'* (NRT staff member).

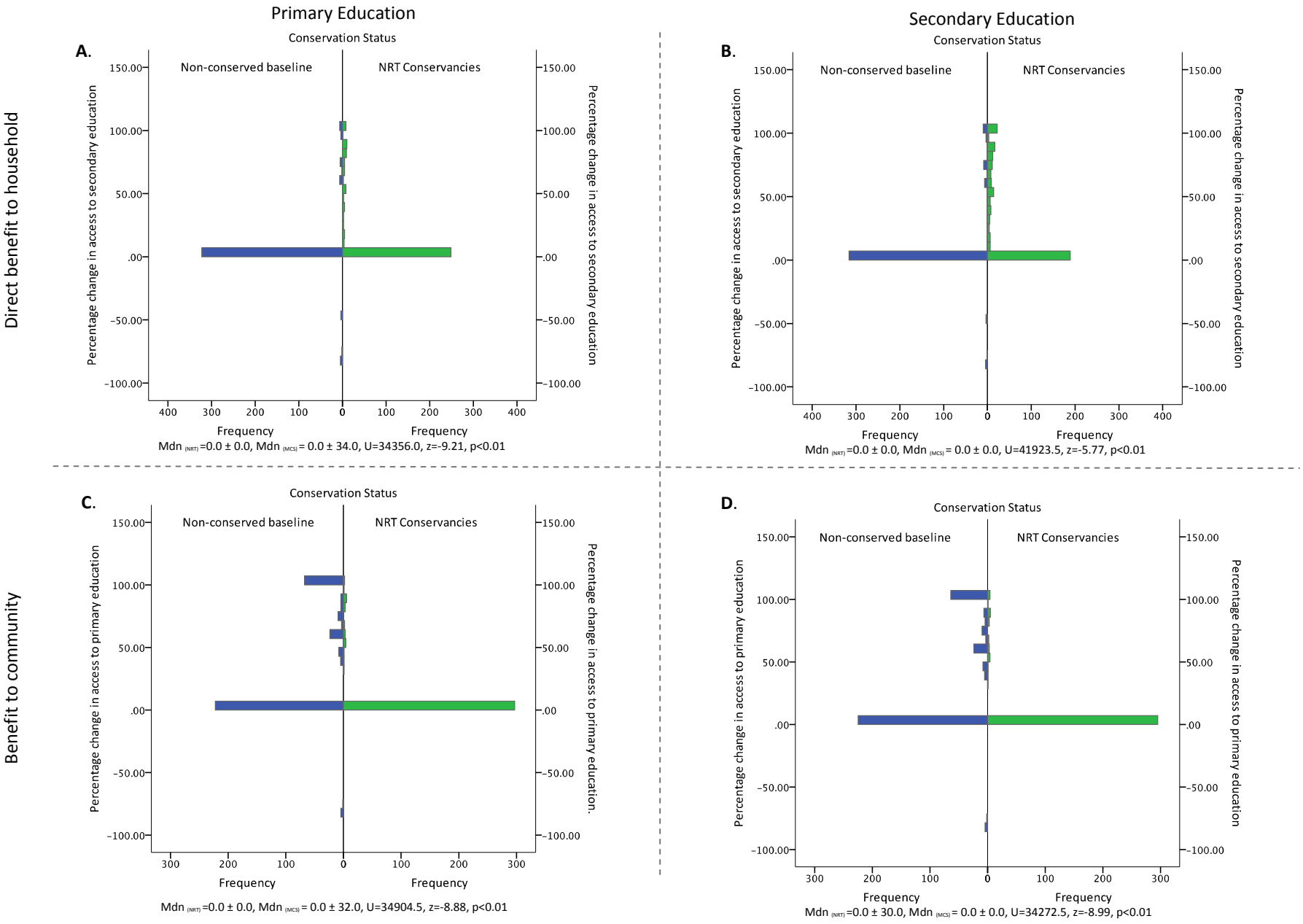
Secondly, as seen in the reporting of changes in transportation and medical care (section 4.2.6), respondents report the final change in the sequence of improving access. In this case, respondents assume access to the pre-requisite primary education is secure for improvements to the availability in secondary education to be useful to their households and communities.

As a result of the Government programme, direct initiatives led by the conservancies were no longer required for primary education. In some areas, such as West Gate, community funds were shifted to enhance pre-school education provision. '*The conservancy is trying to build some pre-Schools and they providing the children with books, with pens and pencils and with shoes. They are also providing the children with food so that when they come to School they can have food. They are paying the pre-School teachers*' (Elder, West Gate Community Conservancy). Typically, however, communities in the conservancies chose to focus their efforts in improving access to secondary and University level education as well as supporting mock examinations and '*…meeting students at the end of year to talk about careers, performances, trying to push students…'* (NRT staff member).

Trends in medical care and water provision

Medical care has become increasingly affordable in conservancy communities, compared to a decline in affordability elsewhere in northern Kenya (Table 4.12). The communities reported that this was a significant impact (Table 4.12), particularly for poorer households where:

Figure 4.10 Frequency of respondents reporting change in access to primary and secondary education in Northern Rangelands Trust conservancy communities and equivalent non-conserving communities in northern Kenya



' [*b*]*before if you don't have a cow or a goat in your home, then if you were sick, you were just given some locals herbs...and you would die because there is no money to take you to the hospital. Right now, when you have a sick person in the community, you just take to the hospital with that little you have and then when you are asked to be admitted, if it is more serious then you say 'OK, fine!' because you know you have got that help from Sera.'*

(Woman from Sere-Olipi, Sera)

Many community members, particularly woman report that the medical funds provided by the conservancy remove much of the stress associated with visiting a doctor. Several women reported incidents whereby hospitals '*...will not discharge you until you bring the money. There are times....you will be forced to....sleep on the floor until you've settled the bill, '*or where patients' families would be told to '*...go and collect firewood, to cover the amount of KSh 3,000.*'

Conservancy vehicles are also important in improving the affordability of medical care acting as ambulances for those unable to afford transportation to hospital. One of the women in Sere-Olipi described the situation:

'*Before, we were just relying on the Catholic Mission Hospital ambulance, and when you call for that ambulance...the first thing that they will ask you is 'Do you have KSh, 5000?' And if you don't have, there's no way* [the ambulance will collect the patient]'

(Female respondent, Sere-Olipi, Sera)

Since the conservancies started, community members can call for the vehicle's assistance in an emergency, a change which was in the top three impacts reported by individual households for all conservancies (Table 4.9). As one woman in Sera explained of the vehicle '*...it's like it's mine. Whenever I have a problem, I can for it and it is settled.'*

In the village of Ngutuk Ongiron, money from West Gate Community Conservancy has been used to construct a water system, which transports and stores water from the Ewaso Nyiro river to the local primary school. An elder explains the impact:

'Before children would go to School, washing their face only without washing the rest of the body. Women will go down to Ewaso to fetch water. There was a time in the dry season where we went to sleep unclean because there was no water. Sometimes it was even dangerous because the elephants would be all over and it was dangerous to get water there. But right now, we have water here, and everybody, the children, will get water, they will get bath, they will go to School, they will eat comfortably. Also the women will not have to very far to fetch water because we have a nearby place now.'

Elsewhere in the conservancies, the provision of drinking water was one of the ten most reported benefits by households in all conservancies. These changes were not statistically significant when compared to communities outside the conservancy network (Table 4.9). This would suggest that the improvements in water provision in the conservancies are complementary to changes occurring elsewhere, rather than an addition benefit of community conservation.

Trends in access to grazing resources

Access to grazing resources is critical for the maintenance of pastoralist livelihoods. Both the perceived availability and perceived quality of grazing have undergone significantly greater increases in conservancy communities compared to their non-conserved counterparts (Table 4.13). The size of the area set-aside by communities had no impact on the reported trends in the availability (r_s=0.5, n.s) or quality (r_s =0.5, n.s) of the grazing resource.

In Namunyak and West Gate, both grazing availability (Namunyak $Mdn_{(NRT)}$ =0.00± SIQR 0.00, West Gate $Mdn_{(NRT)}$ =0.00± SIQR 0.00) and quality (Namunyak $Mdn_{(NRT)}$ =0.00± SIQR 0.00, West Gate $Mdn_{(NRT)}$ =0.00± SIQR 0.00) was reported to have improved significantly compared to matched non-conserved areas (Table 4.13). In contrast, the quality of grazing increased in Sera (Table 4.13), in the absence of a significant change in the amount of the grazing resource. In all conservancies, improvements in grazing were listed among the ten most important livelihoods benefits of the conservancies in household interviews (Table 4.9).

Table 4.13 Comparison of median reported change in grazing availability and quality in Namunyak, Sera and West Gate conservancies, northern Kenya.

Site	Grazing Availability	Grazing Quality
Namunyak	$Mdn_{(NRT)}$=0.00±0.00 $Mdn_{(MCS)}$=0.00±0.00 U=4938.5 z=-6.02, p<0.01.	$Mdn_{(NRT)}$=0.00±0.00 $Mdn_{(MCS)}$=0.00±0.00 U=5986.0 z=-4.26, p<0.01.
Sera	$Mdn_{(NRT)}$=0.00±0.00 $Mdn_{(MCS)}$=0.00±0.00 U=4687, z=-3.77, p<0.01	$Mdn_{(NRT)}$=0.00±0.00 $Mdn_{(MCS)}$=0.00±0.00 U=5484, z=-1.9, n.s
West Gate	$Mdn_{(NRT)}$=0.00±0.00 $Mdn_{(MCS)}$=0.00±0.00 U=2811.5, z=-4.55, p<0.01	$Mdn_{(NRT)}$=0.00±0.00 $Mdn_{(MCS)}$=0.00±0.00 U=3173.5, z=-3.34, p<0.01

Increasing access to the grazing resource is the product of both improved security and resource management. As one elder in Sera explained, '*Now we have plenty of areas to go and graze our animals because we have security*'. The grazing management builds on traditional mechanisms of resource governance which degraded during the Colonial era and post-Independence (Spencer, 2004). The zoned system retains an area of land as a dry season grazing reserve, which can be opened to community members during droughts. This has had important impacts for the *morans* in West Gate:

''Before we would just stay at home for a short period of time and then we would start grazing our animals in far places, in 'fora' [distant grazing pastures].*Right now we can stay here for some time and when it is the dry season, we can be given the chance to graze here. After that, we will go down to fora.'*

Importantly from the perspective of conservation managers, this management has '*….demonstrated to the community that if you do some sort of controlled grazing, you'll see the grass. If you go to the community, they'll say that where the conservation is being done, there's a lot of grass, a lot of pasture'*.

However, in the eyes of both NRT and the communities, the zoned grazing management system has had limited success, largely *'…because it hasn't taken into account the transient nature of nomadism that persists in this region. It hasn't engaged with people coming from further afield, who would have traditionally used that land'* (NRT staff member). This has led to disquiet among some community members, who complain that '*…those who do not have conservancies, they will just come and graze their animals in the conservancies'*. The recognition that implementing a 'hard-boundary' approach to grazing in the region where land tenure and resource access rights are fluid has led to a re-evaluation of appropriate management strategies. This concluded that '*[u]p to now, the buffer and the core have served their purpose but now we need to think beyond and look into better grazing management approaches…*' (NRT staff member).

Trends in access to firewood products

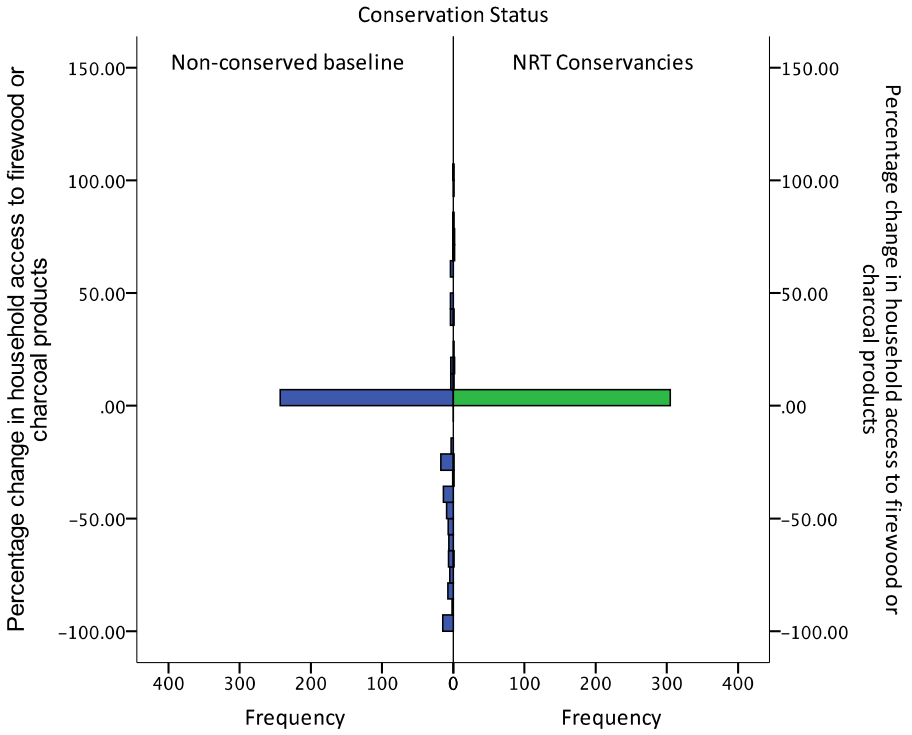
None of the households surveyed in the conservancies reported a change in their ability to access firewood or produce charcoal. This contrasted strongly with responses in non-conserved communities, where a more than quarter (26.0%) of respondents reported a decline, and less than 5% reported an increase in the availability of these resources (Figure 4.11). The stability in access to fuel resources in conservancy areas ($Mdn_{(NRT)}$ =0.0± SIQR 0.0) was significantly different ($U=37264.0$, $z=-8.35$, $p<0.01$) to the widespread declines in non-participating communities ($Mdn_{(MCS)}$ =0.0 ± SQIR 12.0). Consequently, the conservancies can be seen as a 'safety net', reducing fluctuations in resource access in the communities.

Trends in access to timber products

In contrast to access to firewood and charcoal, the availability of large timber increased in NRT communities (Figure 4.12). This occurred in the context of stable or declining conditions in comparable non-conserved areas. In Namunyak, Sera and West Gate, access to timber resources improved significantly as a result of their conservancy status (Figure 4.12). 38% of respondents in the conservancies described changes in access to timber which directly benefitted their households, compared to only 2.7% in non-conserved areas. Within the conservancies, there was no difference in the percentage of respondents reporting a direct benefit to the household (38%) and those reporting a wider benefit to the community (38%). Similarly, there was no relationship between the reported benefit and any demographic or socioeconomic factors. This suggests that

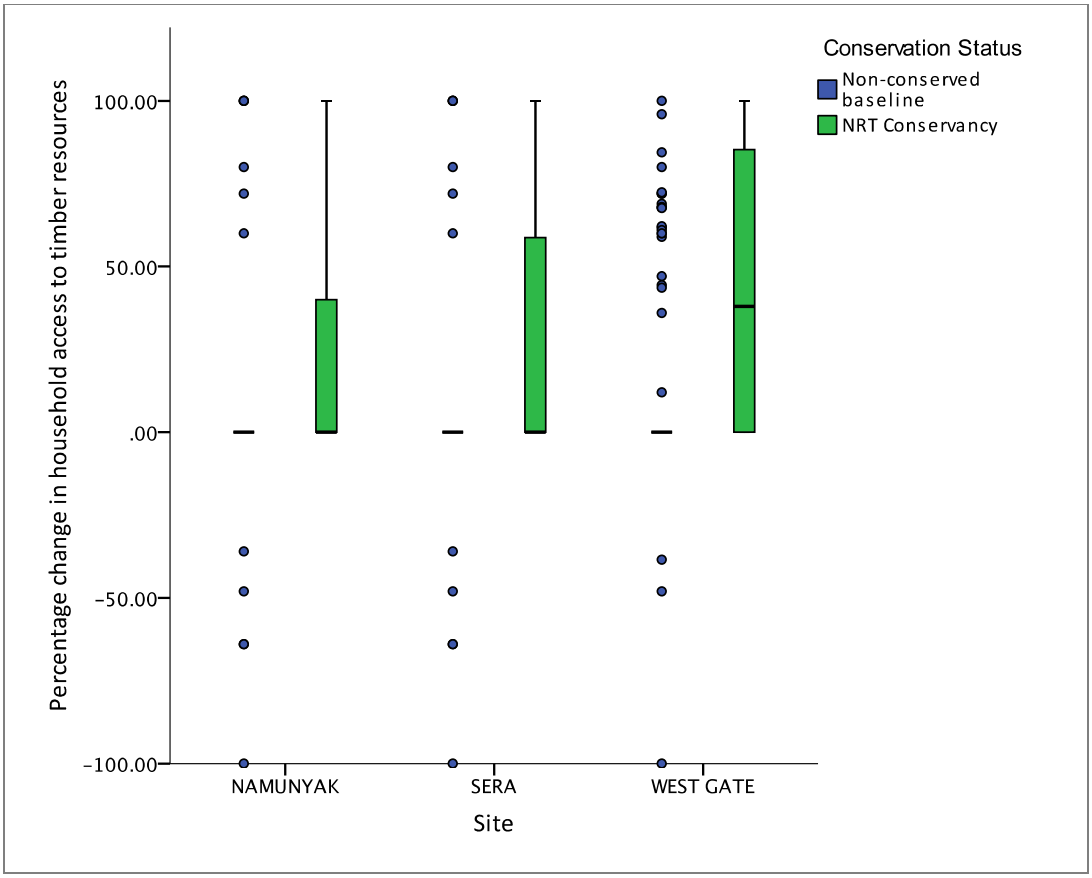
maintaining access to timber is not undertaken as a public good at the expense of household but rather is integral to livelihoods at the household level.

Figure 4.11 Frequency of respondents reporting change in access firewood and charcoal products in Northern Rangelands Trust conservancy communities and equivalent non-conserving communities in northern Kenya



In several villages, households reported that seminars had been held to educate their community about the importance of retaining a stock of large timber trees. In these areas, many respondents reporting that that they been told 'not to cut the big trees' as '*….they bring good shade, winds and rain'* (Golgoltim resident, Namunyak Wildlife Conservancy).

Figure 4.12 Reported changes in household access to timber resources in conserved and non-conserved communities.



Namunyak: $Mdn_{(NRT)}$=0.0±20.5, $Mdn_{(MCS)}$= 0.0±0.0, U=5058.0, z=-4.26, p<0.01; Sera: $Mdn_{(NRT)}$= 0.0 ± 29.7, $Mdn_{(MCS)}$= 0.0±0.0, U=3954.5, z= -6.13, p<0.01; West Gate: $Mdn_{(NRT)}$= 37.9 ± 42.99, $Mdn_{(MCS)}$= 0.0± 0.0., U=1741.5, z=-7.86, p<0.01

5. Conclusions

5.1 Community conservation & livelihoods in northern Kenya

The NRT initiative and its constituent conservancies are significantly enhancing livelihoods for their participating communities when compared to equivalent but non-participating communities (section 4.2.3). These benefits occur at the household and community level, and are derived from revenues produced by conservation-linked enterprises. In two of the three conservancies studied, livelihoods have undergone significantly higher rates of positive livelihood change than has occurred in matched comparison sites (section 4.2.3). In these conservancies, Namunyak and West Gate, community development funds are derived from tourism concessions. In Sera, where livelihoods for some in the community have undergone positive change but where overall change in livelihoods for the community is not statistically significant, a smaller locally-managed tourism concern is the primary source of development funds. This indicates that the level of livelihood as a result of community conservation may be dependent on the level of revenue generated through enterprise development in the region.

Incomes in conservancy communities have not undergone any significant change in diversity during the study period (section 4.4.2), with most households remaining reliant on livestock production for some or all of their income (section 4.4.2). While diversity remained stable, community members in conservancy communities were significantly more likely to report a 'stable or increasing' overall income compared to those in non-conserved areas (section 4.2.2).

5.1.1 Distribution of livelihood benefits in community conservancies

Livelihoods benefits are not equally distributed (section 4.2.3), with different levels of benefit apparent between separate socioeconomic and demographic groups. In the conservancies studied men, resident in the

community for relatively long periods of time from either low or high income households reported the highest rates of livelihood benefit. Interestingly middle income households reported lower average benefit than either their poorer or wealthier neighbours. This may be due to such households failing to access direct financial benefit either through paid employment or via specific poverty alleviation programmes. The latter, which take the form of medical and education bursaries as well as development funds, are targeted initially at lower income households. Consequently, middle-income households may see fewer overall benefits. However, households not directly benefitting financially from the conservancies recognised the importance of those benefits through the community at large, for example through increasing cash-flow in the local economy (section 4.2.6).

The majority of livelihoods components which underwent significant change as a result of community-based conservation were not financial in nature. For both individual households and the wider community, improving physical security due to a decline road banditry and civil insecurity (section 4.2.4), together with access to affordable transportation (section 4.2.6) were the largest changes to their livelihoods brought about by NRT (Table 4.9).

5.1.2 Additive, complementary and stabilising outcomes

The trends in individual livelihoods indicators were varied, representing the dense network of development projects, programmes and actors operating in the region overlaid on a similarly complex socio-ecological system. The resulting 'patchwork' of livelihood change is the product of both current and past initiatives. Consequently it is necessary to divide the livelihoods outcomes of community conservation into three classes. The first are complementary outcomes which community members perceived to important impacts of conservancies but which were not statistically significant due to similar concurrent changes in non-conserved sites. For example, the provision of water was reported to be an important outcome of participating in conservancies in both household interviews and focus group discussions (section 4.2.6). However, similar changes occurring in the matched comparison sites across northern Kenya meant that these impacts were not statistically significant (Table 4.9). Consequently, it may be concluded that improvements to water provision were likely to occur in the conservancy communities during this time period. For this and other complementary outcomes, the impact of community conservation was to shift responsibility for that project from development NGOs or Government to the community itself.

The second type of outcome observed in the community are those which had no parallel in matched comparison sites and thus would not have occurred without conservancy establishment. These 'additive' livelihoods outcomes ranged from access to secondary and higher level education (section 4.2.6), affordable transport (section 4.2.6), security (section 4.2.4) together with access to grazing and timber resources (section 4.2.6). A third group of outcomes are exemplified by access to firewood and charcoal resources (section 4.2.6), whereby conservancies buffered their participating communities from changes in resource access which were

occurring elsewhere. Such 'stabilising' outcomes may dampen fluctuations in access to a particular asset or opportunity, rather than enhancing access outright.

5.1.3 Role of institutional governance

Each conservancy differed in the livelihoods outcomes it had brought about, reflecting the differing social and environmental contexts in which they work, diverse management structures and the communities' own development priorities. In Namunyak, community concerns regarding institutional governance (section 4.2.5) did not detract from the overall provision of livelihoods benefits which was higher than for Sera or West Gate. Rather the quantity and size of livelihoods benefits appears to reflect both the time since establishment and the revenue derived from eco-tourism. Lessons on institutional governance may, however, be drawn from both Sera and West Gate where communities were largely satisfied with performance.

5.2 Community conservation and rangeland condition in northern Kenya

Significant changes have occurred in habitat condition in NRT conservancies compared to non-conserved baseline sites (section 3.2.5). Across all conservancy management zones, green vegetation cover increased significantly in both dry and rainy seasons between 2000 and 2007. The increase in photosynthetic activity has led to the accumulation of senescent vegetation as leaf litter, detected by both the brightness and wetness indices. Leaf litter has an important role in maintaining the nutrient content of soils as well as reducing surface precipitation runoff (Lechmere-Oertel et al., 2005). In the arid rangelands, high volume surface run-off over bare ground is implicated in the gully formation and soil erosion (Mwendera & Saleem, 1997). Consequently, it may be concluded that increased green and senescent vegetation represents improved rangeland condition in community conserved areas.

5.2.1 Impact of zoned management on rangeland condition

Zoned management has affected changes in green vegetation within the conservancies (section 3.2.2). Interestingly, it is the settlement zone, which is not subject to livestock grazing restrictions where the most significant changes have occurred. Green vegetation increases in settlement areas exceed those seen in the core and buffer zones in both the dry and rainy seasons. This impact becomes more pronounced in the dry season, suggesting that it is the browse layer rather than rain-fed growth in grasses that increased in extent or productivity. Conservancy awareness campaigns on the importance of retaining the stock of large trees may be responsible for this change (section 4.2.6). This finding echoes that of Abbot et al. (2001) in Cameroon, where communities receiving benefits from conservation, were 'more positively disposed' to adopting sustainable behaviours. In the case of the NRT conservancies, community members receiving livelihoods benefits derived from grazing and wildlife management may be willing to act more sustainably in other areas, with the expectation of either maintaining or increasing livelihood benefit flows.

Seasonal livestock grazing in the buffer zones has led to greater increases in green vegetation relative to the no-take' core zones during the dry season. Grazing by both livestock and wildlife has been shown to stimulate photo-synthetic activity at certain intensities (McNaughton, 1984). Similarly the deposition of livestock dung may act as a fertiliser and facilitate seed dispersal and establishment (Milton & Dean, 2001). The effect is to create high productivity grazing or browsing 'lawns (McNaughton, 1984; Fornara & Du Toit, 2007). Core zones, whilst experiencing less increase in green vegetation, may act as vital refugia for species, particularly for those intolerant of livestock disturbance whose densities decline rapidly in the presence of livestock (de Leeuw et al., 2001). The greater increase in green vegetation in buffer zones should not be considered as evidence that core zones should be converted from their 'no-take' status.

5.3 Integrated outcomes of community conservation in northern Kenya

Community conservation has significantly enhanced both livelihoods and habitat condition in northern Kenya, when compared to a non-conserved baseline condition. The findings suggest that community conservancies may provide a framework for integrating conservation and development at the local scale. In all three conservancies significant improvements in rangeland condition and livelihoods have occurred, through the development of eco-tourism enterprise. The magnitude and direct of outcomes was, however, variable within the conservancies examined. In Sera, conservancy establishment has not led to a significant overall change in livelihood, despite positive change in some indicators. The reasons for this remain unclear, but are likely to be linked to lower tourism revenues when compared to either Namunyak or West Gate. In the latter, significant impacts have occurred in both ecological and socioeconomic indicators.

Linking conservation and poverty alleviation is a complex task. The NRT conservancies highlight that under some conditions, positive outcomes may be achieved for both people and wildlife.

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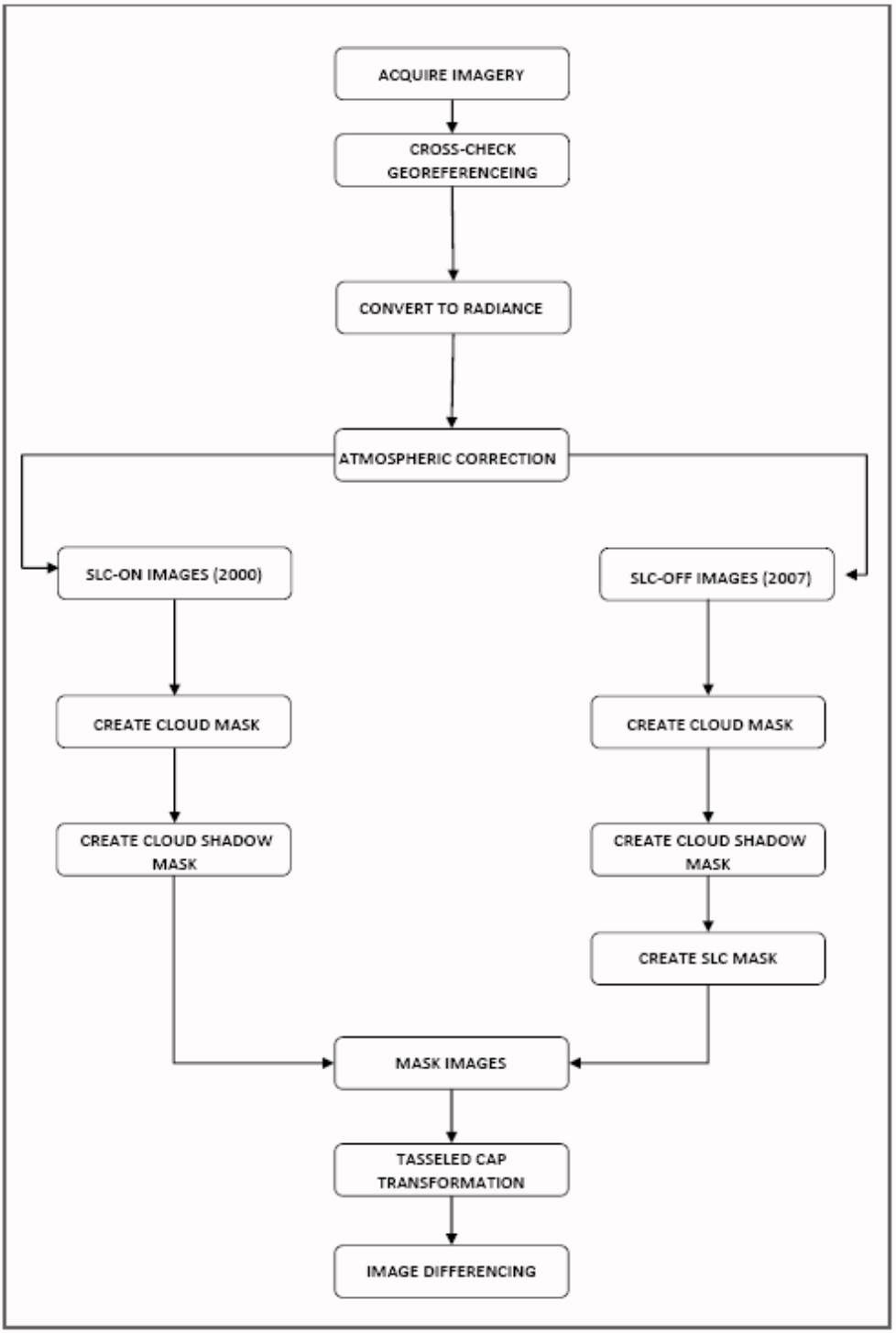
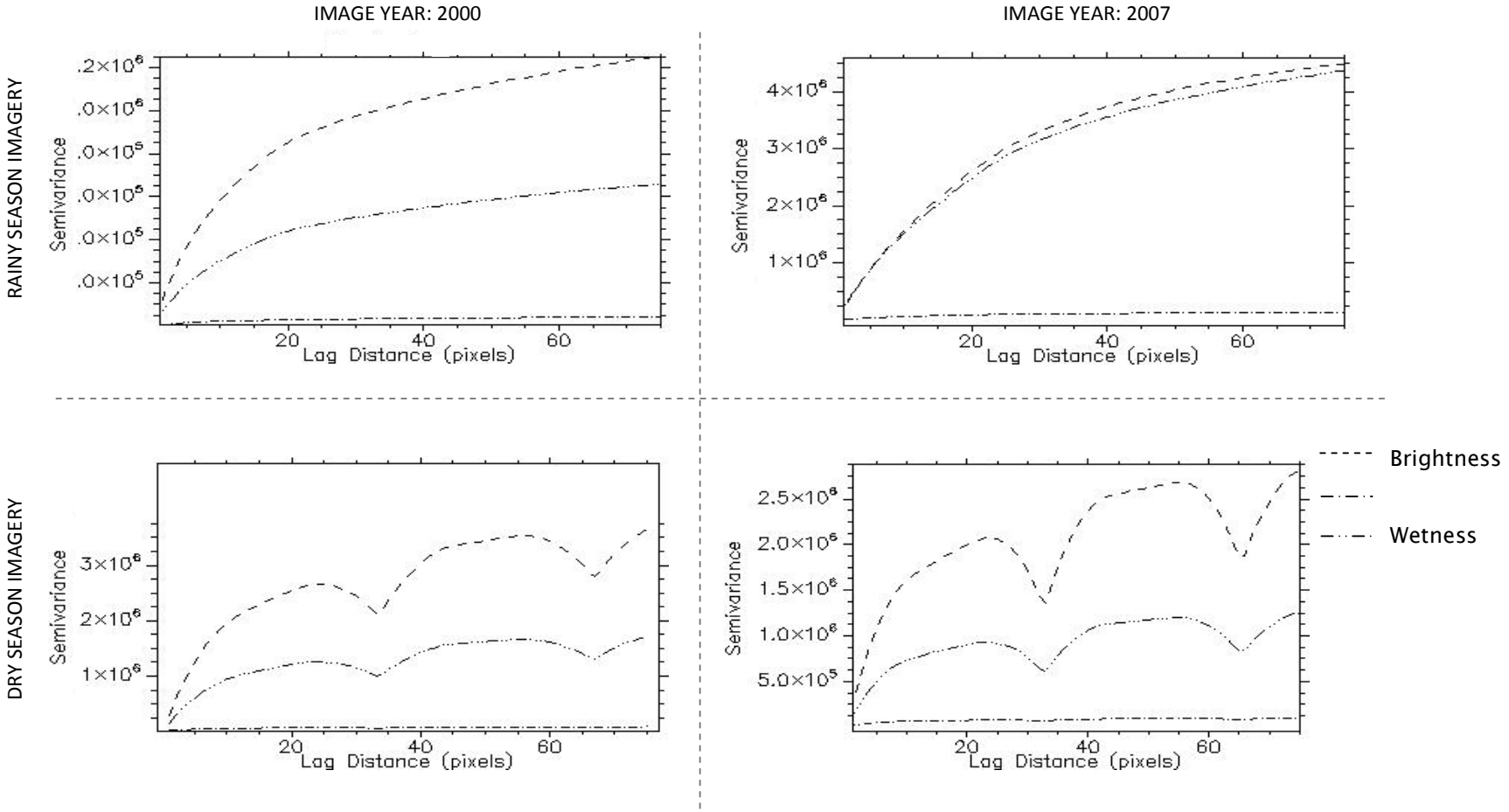
Appendices

Appendix 3.1 Remotely-sensed imagery pre-processing



Appendix 3.2 Semivariograms of autocorrelation in tasselled cap transformed LandSat ETM+ imagery.



Appendix 4.1 Household interview

HOUSEHOLD-LEVEL SOCIOECONOMIC TREND ANALYSIS

Name of interviewer:	Date:
GPS co-ordinates of household:	Study reference: HLO/_____/_____
Associated audio files:	Associated photographs:

Part I. Demographic Data

1. Community Name: _____

2. Name of Household head: _____

3. a) Female-headed household (circle answer): YES NO

b) *If YES,* is the household head:

UNMARRIED SEPARATED DIVORCED WIDOWED

4. Information persons interviewed:

Name	**Role (circle answer)**	**Age/Age Set**
	HH / W1 / W2 / W3 / W4 / W5 / W6 / D/ S / O	
	HH / W1 / W2 / W3 / W4 / W5 / W6 / D/ S / O	
	HH / W1 / W2 / W3 / W4 / W5 / W6 / D/ S / O	

5. a) How many people live in your household? _____

b) Could you tell me their ages and whether they are male or female?

Name	*Gender*	*Age/Ageset*

Name	*Gender*	*Age/Ageset*

6. How long has your household lived in the community?

_____

7. What ethnic background or tribe do you consider yourself to belong to?

ARIAAL BORAN EL MOLO GABRA MERILLE

POKOT RENDILLE SAMBURU OTHER PREFER NOT TO RESPOND

If other, please specify: _____

Part II Socioeconomic Data

1. Wealth

a)

_____

__?

b)

_____

__?

c)

_____

__?

d)

_____

_?

2. What is the main source of income to your household?

3. Has the main source of income to your household changed since Namunyak was established?

4. Has the amount of income to your household changed since Namunyak was established?

Increased Decreased No Change Don't know

5. Livelihoods trends.

Activity	Period 1 (PRE_NAM)	Period 2	Period 3	Period 4 (TODAY)
Livestock				
Employment				
Relief				
Traditional Crafts				
Casual Work				
Remittance				
Honey				
Small scale enterprise				
Charcoal production				
Other:				
Other:				

Other:				
Other:				
Other:				

PHOTOGRAPH #:_____

PHOTOGRAPH FILE NAME:_____

6. Now, I'd like to ask you if there have been other changes that have affected your household since 1995?

Photograph #: _____

Photograph file name:_____

Indicator	Positive	Negative	No Change	Not relevant	Impact Upon	Attribution/Explanation
Availability of grazing						
Quality of grazing						
Access to/availability of timber						
Access to/availability of fuelwood						
Access to/ availability of water for livestock						
Access to/availability/quality of water for household						
Livestock production						
Livestock marketing						

Indicator	Positive	Negative	No Change	Not relevant	Impact Upon	Attribution/Explanation
Livestock health						
Access to transport (roads, lifts)						
Access to education						
Access to health care and clinics						
Support from government						
Support from donor organisations						
Security for people						
Security for livestock						
Security from wildlife attack						
Access to paid employment						

Indicator	Positive	Negative	No Change	Not relevant	Impact Upon	Attribution/Explanation
Access to other sources of income (e.g. crafts).						
Penalties						
Any other changes (specify):						

Have there been any benefits to your household as a result of conservation?

Have there been any costs to your household as a result of conservation?

Are you involved in the management or decision-making involved in Namunyak Conservancy?

Appendix 4.2 Focus Group Protocol

Draft Focus Group Protocol (Version 2.2 17th March 2010)

Conducted in small groups of 8-10 people

Groups are homogeneous, with three FG conducted in each community (women, morans, elders).

Two facilitators for each, viz. project leader (Louise) and a research assistant, plus a bilingual information recorder.

All meetings conducted in local language, either KiSwahili or KiSamburu (plus translation for project leader).

Groups to start with a general question on conservancy impact, with responses noted on a flipchart, and then ranked in order of importance.

EDUCATION

Has the conservancy had any effect on the availability of education for children in this community?

Has the conservancy had any effect on households being able to afford school fees/uniforms in this community?

Has the conservancy contributed to community members learning new skills?

INFRASTRUCTURE/TRANSPORT

Has the conservancy had any effect on the ability of community members to travel in this area?

Has the conservancy had any effect on the infrastructure of this community (e.g. sanitation, wells, water tanks, roads)?

HEALTH

Has the conservancy had any effect on the general health of this community?

Has the conservancy had any effect on the availability of health care in this community?

PHYSICAL SECURITY

Has the conservancy had any effect on the security of people living in this community?

ACCESS TO RESOURCES

In your perception has access to resources (e.g. grazing) changed in any way since the conservancy was established?

VULNERABILITY

In your opinion, have there been any changes in how the community copes with resource shocks, such as drought or flood? Has this affected all community members equally?

GOVERNANCE AND EMPOWERMENT

Have any other committees or community groups been established since the conservancy was started?

Is anyone in this group a member of a committee related to the management of the conservancy?

Do you feel that you are able to influence decisions related to conservancy management?

Do you feel that, in general, there is transparency in the way conservation management decisions are made?

How often do meetings about the conservancy take place? What matters are addressed in those meetings?

Has the formation of committees or groups related to conservancy management helped the community?

SOCIAL COHESION

Has the conservancy had any effect on the unity of this community?

Has the conservancy affected the number of conflicts within this community (.i.e. between community members?)

Has the conservancy affected the number of conflicts between your community and those not involved in the conservancy?

ROLES OF MEN, WOMEN AND CHILDREN

Has the conservancy changed what a woman typically does in her daily activities in this community?

Has the conservancy changed what a man typically does in his daily activities?

Has the conservancy changed what a child typically does in his daily activities?