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KILOMBERO AND LOWER RUFJI WETLANDS ECOSYSTEM MANAGEMENT PROJECT

TECHNICAL ADVISORY SERVICES FOR BIODIVERSITY CONSERVATION AND WETLAND MANAGEMENT IN KILOMBERO VALLEY RAMSAR SITE

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PASTORALISM DIAGNOSTIC STUDY

TANZANIA

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Acronyms & Abbreviations

BAKWATA	National Muslim Council of Tanzania
BTC	Belgian Technical Cooperation
HHQ	Household Questionnaire
KGCA	Kilombero Game Controlled Area
KII	Key Informant Interview
KILORWEMP	Kilombero and Lower Rufiji Wetlands Ecosystem Management Project
KV	Kilombero Valley
KVRS	Kilombero Valley Ramsar Site
KVTC	Kilombero Valley Teak Company
MNRT	Ministry of Natural Resources and Tourism
PRA	Participatory Rapid Appraisal
TANAPA	Tanzania National Parks
TAWIRI	Tanzania Wildlife Research Institute
TEV	Total Economic Valuation
TFDA	Tanzania Food and Drug Authority
TZS	Tanzanian Shilling
WMA	Wildlife Management Area

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EXECUTIVE SUMMARY

This report provides an overview of the current status of livestock keeping in the Kilombero Valley. It has been prepared under the framework of and as a contribution to the KILORWEMP Project (Kilombero and Lower Rufiji Wetlands Management Project), currently being implemented as a collaborative effort between Belgian Technical Cooperation (BTC) and the Tanzania Ministry of Natural Resources and Tourism (MNRT) with financial support from Belgian Aid and the European Union. The overall goal of KILORWEMP is to promote the sustainable management of the wetlands ecosystem of the Kilombero Valley and Lower Rufiji.

The report incorporates and synthesizes the findings of an initial PRA study and a subsequent detailed household questionnaire (HHQ) survey, combined with insights obtained through key informant interviews (KIIs) concerning the structure and functioning of the cattle meat chain within the Kilombero Valley. Field work was carried out from June to September 2016.

The study highlights the important contribution of livestock to the local economy, through supporting pastoral families, enhancing agricultural production, providing the basis for the supply chain of red meat in the Kilombero Valley and in terms of contributions to government revenues in the form of fees, taxes and fines.

Development of the livestock production system within the Kilombero Valley has been fuelled by the in-migration of Barbaig, Maasai and Sukuma pastoralists from elsewhere in the country, particularly over the last 20 years. The system remains in considerable flux. Integration with farming is progressing rapidly as traditional pastoralist families increasingly turn to crop production, while traditional farming families increasingly adopt livestock production, primarily as a means to access cattle traction services and so enhance agricultural output.

Increasing numbers of livestock producers will provide continued stimulus for the future growth of cattle populations; at the same time rapid human population growth is similarly fuelling demand for land for settlement and farming purposes, thus eroding the available grazing resources. Already there is significant conflict between livestock keepers and farmers, mainly due to livestock entering fields and causing damage to crops.

With growing constraints on access to grazing resources, a considerable number of pastoralists are making use of fodder and water resources within the Kilombero Game Controlled Area (KGCA). Previously, national and local authorities have responded with a heavy hand, particularly through Operation Tokomeza, a programme of forced destocking and evictions implemented during late 2012 and early 2013.

Given the essential role of livestock to the local economy, to improving livelihoods and to reducing poverty, the study recommends seeking to accommodate and promote livestock production, including within the KGCA, as opposed to continuing on the existing path of continual confrontation. This will require development of new mechanisms to regulate livestock numbers and presence in order to limit associated potential detrimental environmental impacts. Incorporating livestock and working with pastoralists may also contribute towards halting further expansion of farms into the KGCA.

Key findings are presented below in relation to the main lines of enquiry as requested under the study framework.

Table 1. Key findings of the study.

Issues	Main Findings
a. The pastoralist background in the KVRs	
Pastoralist's household livelihoods and patterns of land access and use within KVRs	<p>Livestock keepers in the Kilombero Valley comprise a mix of immigrant Sukuma, Maasai and Barbaig "large pastoralists", and other "small" livestock keepers belonging to a number of other tribes such as Ndamba, Bena, Ngoni and Pogoro, many of whom are considered as indigenous to the valley.</p> <p>The community of livestock keepers is dominated by Sukumas, then small pastoralists, then Barbaig and Maasai; numbers of cattle appear to follow the same pattern of ownership.</p> <p>The distinction between large and small livestock keepers is not clear cut, with some large pastoralists having few cattle (<10) and some small keepers having large numbers of animals (up to 100).</p> <p>Virtually all livestock keepers also carry out some farming. One quarter of HHQ respondents recognized crop farming as their most important livelihood activity, another 39.0% considered themselves as mixed producers (crop and livestock producers).</p> <p>The proportion of HHQ respondents who identified themselves as being primarily livestock keepers was highest among Barbaig and Maasai, intermediate for Sukumas and lowest for other tribes and, conversely, the proportions of crop farmers were lowest for Maasai and Barbaig, intermediate for Sukumas and highest for other tribes.</p>
Formal and informal land access systems	<p>Most, but not all, pastoralists have followed formal channels and are registered in the village where they live.</p> <p>Some pastoralist families have come to join their families and have not registered within villages.</p> <p>Most pastoralist households own land in the village where they reside, with an overall mean estimated value of 36.7 acres per household.</p> <p>Land is typically used for crop and livestock production, or else just crop production.</p> <p>Sukumas tend to own private land for farming and livestock keeping whilst Maasai and Barbaig often do not own private land, such that they are reliant on access to communal land for grazing of livestock.</p>
Current integration with farming	<p>Integration with farming is significant and growing.</p> <p>Large pastoralists are increasingly turning to crop production, particularly for Sukumas and less so for Barbaig and Maasai, whilst there is growing adoption of livestock production among other resident tribes, largely driven by increasing recognition of the value of draft animals for ploughing (as well as for transport and manure).</p> <p>Among livestock producers, 58.1% of total income was reported to be derived from livestock and 39.0% from crop production. Maasai and Barbaigs derive the bulk of their income from livestock, with some supplementary income from crops and running small businesses; members of other tribes derive their principal income from crops supplemented by earnings from livestock and businesses; and Sukumas occupy an intermediate position earning their major income from livestock, but with additional significant income from crops, plus some</p>

Issues	Main Findings
	<p>from businesses.</p> <p>Virtually equal expenditure was reported on livestock and crop production. Barbaigs, Maasai and Sukumas invest more in livestock than “Other tribes”, whilst the pattern is reversed for crops.</p>
<p>Opinions held by pastoralists and other stakeholders on resource conflicts: causes and solutions</p>	<p>Pastoralists face a number of restrictions that have been imposed on their livestock keeping activities, including grazing in village protected areas, grazing in neighbouring villages and grazing inside the KGCA, as well as concerning the use of certain water sources. The bulk of conflicts arise through violating such restrictions.</p> <p>Key institutions responsible for enforcing rules and regulations include village governments, KGCA/RAMSAR authorities and TANAPA/wildlife authorities; ward councils and district authorities were seen as being less relevant in this respect.</p> <p>The main form of conflict is between livestock producers and farmers due to cattle entering fields and damaging crops. This is most frequent during the rainy season.</p> <p>Other important forms of conflict are with the KGCA/RAMSAR authorities and with village governments.</p> <p>Conflict with KGCA/RAMSAR is caused by pastoralists grazing and watering cattle within the KGCA area, most frequently during the dry season.</p> <p>Conflicts with village governments centre around access to grazing resources and include restrictions on where livestock can graze, cattle intruding into farms, and village protected areas, the absence of designated grazing areas, the conversion of grazing areas into fields, and the expansion of farms such that livestock movement routes are constricted or blocked.</p> <p>Livestock producers have a perception that village governments do not understand and support livestock production; that in cases of disputes they tend to side with farmers and impose unfair penalties on livestock producers, including the confiscation of cattle; that they impose unreasonably high fees and restrictions in terms of cattle numbers and the marking of cattle (note that such regulations concerning cattle numbers and the marking of cattle are mandated by district governments rather than at the village level); while neglecting to invest in livestock infrastructure.</p> <p>Conflicts with other groups do occur but were considered to be of relatively minor importance, including among pastoralists themselves and with large investors, as well as with fishermen and wildlife.</p> <p>Impacts of restrictions and conflicts include restricted access to grazing resources and inadequate access to water. These lead to a range of secondary impacts including heavy fines, poor livestock health and condition, lower rates of reproduction and even death of animals. Poor animal health leads to lower productivity, lower prices and income and thus increased poverty. Limited access to grazing also leads to increased conflicts, with cattle being confiscated or killed, and harsh treatment of pastoralists, leading to an eventual decline in pastoralism.</p>
b. The livestock resource	
Size, composition	Cattle are the most commonly kept type of larger livestock, and by far the

Issues	Main Findings
and condition of herds, seasonal distribution and movement of livestock	<p>most important, followed by sheep and goats and chickens. Cattle account for 95.6% of the overall estimated value of livestock.</p> <p>Herd sizes, among HHQ respondents, varied from 2-700, with an overall mean of 50.5 cattle per household. Differences between tribal groups were marked, with mean herd sizes varying from 14.6 for members of other tribes, to 57.5 for Maasai to 60.2 for Sukumas to 98.4 for Barbaig. Cattle comprise various types of Tanzania Shorthorn Zebus, of which the most numerous among HHQ respondents were Tarime/Mara (59.5% of overall herd), followed by natural/Maasai (20.4%) and Ankole (12.7%).</p> <p>Most owners keep their cattle in a single herd. About one sixth of HHQ respondents reported keeping some animals belonging to others, and that some of their own animals were in the herds of others, in both cases usually elsewhere in the Kilombero Valley.</p> <p>For the 300 HHQ respondents, the overall herd comprised 5,868 cows, 3,198 calves, 2,604 heifers, 2,387 steers and 1,005 bulls.</p> <p>Cattle populations are currently growing fast. HHQ respondents, for the last 12 months, reported growth of 4,257 animals mainly through natural reproduction and purchases, versus losses of 2,069 animals principally through sales and deaths.</p> <p>Most households graze their animals in the same place each year. Cattle are principally grazed within village areas during both wet and dry seasons, mainly within reserved portions of farmlands during the wet season, and on crop residues in fields during the dry season. Use is also made of grazing resources in neighbouring villages and within the KGCA, particularly during the dry season. Only three villages had designated grazing areas and these were reported to be too small.</p>
Habitat requirements, migratory routes, interaction with wildlife	<p>The most important requirements for cattle production are grazing areas and water sources; other supporting needs are for veterinary supplies, extension services, plunge dips and markets.</p> <p>Although the Kilombero Valley offers excellent conditions for livestock production, access to pastures and water sources were identified as the two main challenges faced by pastoralists.</p> <p>Three quarters of HHQ respondents considered grazing resources to be inadequate, varying in general accordance with herd sizes from 60.5% for "Other tribes" to 75.6% for Sukumas to 83.3% for Barbaig and 88.2% for Maasai.</p> <p>Principle constraints include the absence of designated grazing areas, grazing areas often being constrained by farming activities, and continued encroachment by farms into grazing areas.</p> <p>During the rainy season pastoralist principally water their livestock in scattered rain water ponds within the village areas. During the dry season, nearly all rain water ponds dry up and most pastoralists make use of the Kilombero River and/or its tributaries, natural water dams, and constructed water ponds. Some of these are located inside the villages and some within the KGCA.</p> <p>The majority of HHQ respondents (77.7%) considered existing water sources to be generally adequate, with only 22.4% expressing reservations.</p> <p>The main problems regarding access to water resources were</p>

Issues	Main Findings
	<p>inadequate water points, restrictions on access to certain water points, water sources are surrounded by farming activities, and stock routes to water points are narrow.</p> <p>For HHQ respondents, the main sources of information about livestock management were from family members (46.0%), from other livestock producers (41.3%), from extension agents (32.3%), village leadership (14.7%) and cellphones (13.0%). Only 25.7% of respondents recalled being visited by an extension officer during the last 12 months, of whom one third reported a single visit and two thirds two visits.</p>
Use of grazing and water resources within the KGCA	<p>The two primary challenges faced by pastoralists are inadequate grazing areas and difficulties in accessing water sources.</p> <p>In response to inadequate grazing areas and water sources in village areas, and the absence of any alternatives, some pastoralists graze and water their animals within the KGCA, particularly during the dry season. This leads to conflict with the KGCA management authorities and the imposition of fines on offenders. Pastoralists identified such heavy fines as the third most important challenge that they face.</p> <p>Driven by decreasing grazing areas in village areas, as additional lands are continually allocated to new settlements and fields, combined with growing livestock populations, the level of use of resources within the KGCA and associated extent of conflicts can only be expected to increase.</p>
Interactions with wildlife	<p>Due to massively depleted wildlife populations, interactions with wildlife are now limited, and are expected to continue to decline in future.</p> <p>Occasional losses of livestock to crocodiles, lions and hyaenas were reported.</p>
Drivers and trends of natural resources and livestock	<p>Most natural resources were perceived to have declined from the past to the present and were expected to continue to do so into the future, including access to land, size of farms, crop yields, forest resources, wildlife, rivers and fish.</p> <p>Perceived drivers of change included population growth, expansion of fields, poor land use planning, losses of land to investors, illegal use of resources and poor law enforcement, decreasing soil fertility, and climate change.</p> <p>Future predictions for livestock were mixed with some participants predicting continued growth due to increased use of livestock for ploughing. However, the majority expected declining cattle populations due to human population growth and continued expansion of farms into grazing areas, coupled with restrictions on livestock numbers, impacts of heavy fines and changing lifestyles whereby in future children may prefer to follow other activities than livestock keeping.</p> <p>Livestock were recognized as causing a range of detrimental impacts to the environment, including physical degradation of wetlands and water sources, pollution of water sources, compaction of soils and increased soil erosion, and losses of biodiversity.</p>
Livestock health issues	<p>Diseases account for the bulk of cattle deaths, followed by accidents, predators and other causes.</p> <p>The most frequent diseases were Contagious Bovine Pleuro Pneumonia,</p>

Issues	Main Findings
	<p>lung disease/coughing, foot and mouth disease, lumpy skin disease, unknown disease, ndigana, trypanosomiasis, East Coast Fever, ndorobo, anaplasmosis and ndui.</p> <p>Virtually all HHQ respondents reported giving their cattle some form of health care over the last 12 months; this was overwhelmingly self-administered (94.0% of HHQ respondents). The principal forms of treatment were spraying, administering curative medicines, deworming and vaccinating. Only 2.7% of respondents reported dipping their animals.</p> <p>Annual cattle deaths were perceived to have declined since 2000 to present, mainly due to improved availability of veterinary products, and this trend was predicted to continue into the future.</p>
c. Economic Value of the Sector in the KVRs	
Identification and assessment of drivers for pastoralism at national scales	<p>Key drivers of pastoralism at the national level include:</p> <p>Population growth,</p> <p>Increased demand for land (including for family farming, conservation and for large farming and tourism businesses),</p> <p>National policies and legislation on livestock, governance, management of land and natural resources, and economic development</p> <p>Conflicts, including state sponsored displacements and evictions from former range areas</p> <p>Climate change, resulting in increased magnitude and frequency of extreme climatic events such as droughts and floods</p>
Assessment of the economic value of the sector within the KVRs	<p>A Total Economic Valuation (TEV) framework has increasingly been applied to assess the overall economic contribution of pastoralism; however even in a simplified form the TEV framework remains a vast territory of enquiry and was beyond the scope of the present study. Here, it was attempted to quantify marketed products and services, and to provide a preliminary analysis of the local red meat value chain.</p> <p>The most frequently reported cattle products and services were for ploughing fields (93.0% of HHQ respondents), milk (84.3%), sales of live animals (45.3%), meat (24.3%) and use for transport (19.7%).</p> <p>The most frequent forms of income were through ploughing (52.7%), followed by selling live animals (45.3%) and milk (37.0%), providing transport (7.3%) and the selling of meat (2.7%).</p> <p>In terms of income generation, live sales were the major earner (537.5 million TZS), followed by milk (474.1 million TZS), then ploughing (87.6 million TZS), meat (7.1 million TZS) and transport (3.7 million TZS).</p> <p>Scaling these figures up from the household survey (300 respondents) to the reported overall number of cattle keeping households in the three districts (13,842 households), the estimated total annual income from livestock for the three districts is 49.9 billion TZS. This figure excludes additional values of subsistence production, inputs to other sectors, meat chain linkages and complementary products derived from grazing grounds.</p>
Local meat chain	<p>Most cattle are sold at auctions. Purchasers include large buyers (who use trucks to move animals to distant markets outside the region), small buyers (who supply meat to urban centres within the Kilombero Valley),</p>

Issues	Main Findings
	<p>and pastoralists themselves who buy animals for restocking purposes. From the auctions, cattle are taken on foot to urban centres for slaughtering. All slaughtering takes place at designated slaughter slabs. After slaughter, heads, leg joints, stomachs and some internal organs may be sold directly to food vendors. Other meat is generally transported to butcheries, which provide the formal outlets of meat. The main buyers of meat include individual consumers, government workers, institutions like schools, and restaurants and bars, of which the latter purchase meat for onward processing and trading.</p> <p>The meat chain thus encompasses a wide variety of participants. In addition to pastoralists, it includes service providers (such as suppliers of veterinary products); livestock extension agents; hired labour (for herding, moving animals to markets and urban centres, and for skinning of animals); traders and brokers (large traders, small traders/butchers and pastoralists); slaughter slab owners; slaughterers; transport riders who move meat from slaughter slabs to butcheries (by bicycles or motorbikes); government inspectors (livestock officers and health officers, who inspect live animals at auctions, animals and meat at slaughter slabs, and buildings and hygiene conditions at butcheries, bars and restaurants), food vendors, business owners (of butcheries, bars and restaurants) and their employees (such as cooks and waiters), license inspectors (business and TFDA licenses) and health workers who provide mandatory health checks for workers in butcheries and restaurants and bars.</p> <p>The meat chain generates considerable revenues in the form of market fees, movement permits (outside of districts), fees for the use of slaughter slabs, fees for business and TFDA licenses, income taxes, as well as in the form of rentals and utility fees.</p> <p>Prices of cattle and meat vary seasonally in relation to supply and demand, being lower in the dry season due to high supply (many farmers selling livestock to raise money for crop requirements) and low demand (limited “free” money and ready availability of cheaper alternatives in the form of fish and green vegetables), and higher in the dry season due to lower supply (many producers can sell crops instead of livestock) and higher demand (more money circulating and fewer alternatives).</p>
d. Management and integration of pastoralism	
Literature review of the lessons learned regarding the integration of pastoralism in agriculture landscapes in Tanzania, East Africa and beyond as relevant, pointing out concrete policy and planning options	<p>Pastoralists are often minorities living in geographically remote areas away from centres of economic and political activity and, thus are often marginalized socially, politically and economically.</p> <p>Pastoralists typically live in remote areas which suffer from poor levels of services such as education, health and water supply.</p> <p>Pastoralists suffer from a general negative perception whereby they are viewed as being backward and resistant to progress, tribalistic, non-nationalistic, rebellious and illiterate.</p> <p>Pastoralists suffer from inadequate representation in decision making structures and processes from local to national levels.</p> <p>Pastoralists lack the necessary knowledge and skills for protecting and demanding their rights.</p> <p>Policy makers, driven by misperceptions of pastoralism and their</p>

Issues	Main Findings
	<p>disapproval of a way of life that is not their own, have persisted in developing inappropriate policies and interventions, particularly in areas of governance, management of land and natural resources and economic development.</p> <p>Pastoralists have become increasingly vulnerable due to population growth and climate change, the effects of which are greatly exacerbated by unfavourable policy and legal environments.</p> <p>Demographic trends are very much linked with other trends in pastoral areas, especially as regards loss of rangeland and commercialization of livestock production and marketing.</p> <p>Pastoralists often suffer from a lack of land ownership and insecure tenure.</p> <p>In some areas pastoralists have suffered from policies that have constrained their mobility hence diminishing access to rangeland resources.</p> <p>There is a clear linkage between pastoralism and enhanced agricultural production, through use of animals for traction, use of manure to enhance soil fertility, and use of livestock in provision of financial services.</p> <p>Agropastoralists, such as the Sukuma, often provide an important link in terms of general understanding and acceptance between sedentary farming communities and mobile pastoral communities.</p> <p>In areas of relatively high rainfall, where crop production is a viable option, pastoralists are coming under increasing pressure from farmers and, in the absence of tenure, often lose their land and way of life.</p> <p>Sedenterization of pastoralists, as is happening in the Kilombero Valley, typically results in ecological changes, economic changes, and changes in dietary intake and health and social life.</p> <p>Women and children are particularly vulnerable to impacts of sedentarization, which despite better access to education and health services, often results in poor nutrition, inadequate housing, lack of clean drinking water, and higher rates of infectious diseases.</p> <p>Official statistics tend to overlook many important benefits of pastoral livestock production leading to under appreciation of the contribution of pastoralism to local, national and regional economies, hence the need to adopt a more robust TEV approach.</p>
Potential policy and planning options	<p>Improve understanding and perceptions of pastoralists</p> <p>Develop capacity of pastoralists to participate in debates</p> <p>Support pastoralists to improve representation in decision making bodies at local and national levels</p> <p>Support investment in rural infrastructure, including roads, access to clean water and education and health services</p> <p>Investigate and address the particular needs of women and children in pastoral societies</p> <p>Support pastoralists in venturing into crop production</p> <p>Develop local conflict resolution systems</p>
Efficacy and equity of measures put in place by GoT / LGAs	<p>Although grazing and watering of livestock within the KGCA is restricted, pastoralists continue to utilize resources within the KGCA, particularly during the dry season, and are commonly fined for doing so.</p>

Issues	Main Findings
especially since 2012 to manage the livestock and pastoralism sector within the KVRs	<p>Previous efforts to remove pastoralists from the KGCA in 2012/2013 were implemented with unacceptably high costs to pastoral communities, do not appear to have been successful and should not be repeated.</p> <p>Whilst many pastoralists suffered strong detrimental impacts under this programme, it appears that cattle populations within the KGCA have rapidly re-established.</p> <p>In future, such exercises are likely to be subject to much higher levels of scrutiny and accountability; and it is likely that any evicted families will need to be provided with fair compensation and access to alternative lands. The costs of such measure are likely to be prohibitive.</p> <p>Existing district livestock plans provide for standard livestock development interventions aimed at modernizing the livestock sector in line with the national livestock policy. Implementation has been minimal due to budget constraints.</p> <p>Other than some advocacy work following the previous evictions, there has been virtually no other NGO support to the livestock sector in the Kilombero Valley.</p>

1 INTRODUCTION

The Kilombero and Lower Rufiji Wetlands Management Project, or KILORWEMP, comprises a collaborative effort between Belgian Technical Cooperation (BTC) and the Tanzania Ministry of Natural Resources and Tourism (MNRT), which is currently being implemented with financial support from Belgian Aid and the European Union. The overall goal of KILORWEMP is to promote the sustainable management of the wetlands ecosystem of the Kilombero Valley and Lower Rufiji.

As part of this programme, KILORWEMP is providing support to planning initiatives, specifically through development of a General Management Plan for the Kilombero Game Controlled Area (KGCA) and an Integrated Management Plan for the larger Kilombero Valley Ramsar Site (KVRS). Sound technical information is required to inform these planning processes and in this respect a number of critical gaps have been identified. Accordingly, in early 2016 KILORWEMP contracted AMBBERO Consulting GmbH to conduct a series of diagnostic studies regarding the land, livestock and fisheries sectors. This report presents the findings of the diagnostic study of the pastoral or livestock sector within the Kilombero Valley.

The remainder of the report is divided into a further three main sections. Sections 2 and 3, respectively, provide descriptions of the methodology and an outline of the main results. This is followed by a discussion of the key findings and their implications as concerns future development and management of the pastoral sector in the Kilombero Valley (Section 4). Additional supporting information is presented in a series of accompanying annexes.

2 METHODOLOGY

The study was carried out by a team of five consultants comprising four local consultants: Dr. Felister Mombo, Qambemeda Nyanghura and Beatus Temu from Sokoine University of Agriculture, Morogoro and Dr. Maurus Msuha from Tanzania Wildlife Research Institute (TAWIRI), Arusha, plus an external consultant, Rob Cunliffe. In general, the external consultant bore primary responsibility for the design and overall reporting of the study, whilst the local consultants took the lead in collecting and carrying out initial analyses of the field data.

The study was implemented during the calendar year of 2016. It included:

- A literature review relevant to the pastoral sector in Kilombero Valley
- An initial field visit to Kilombero and Ulanga Districts
- Design of the study
- Collection of field data
- Data analysis and reporting
- Feedback workshop

The terms of reference for the study are included in Annex1.

The initial field trip included a reconnaissance flight over the study area and provided opportunity to meet with regional authorities in Morogoro and district authorities in Kilombero and Ulanga. Together with the literature review, and in conjunction with existing experience, this provided important baseline context for design of the field study. Key findings from this initial trip, as described in the inception report, are included in Annex 2. Annex 3 comprises a bibliography of the pastoral references that were obtained and examined.

The general approach to collecting field data was to conduct an initial PRA study, the results of which were used to inform the development and subsequent implementation of a detailed household questionnaire. In line with the available resources, the PRA study was implemented in 15 villages and 300 questionnaires were carried out.

In selecting study villages for the PRA exercise, the sample area was taken as the entire extent of Kilombero, Ulanga and Malinyi Districts, but with a primary focus on those villages situated within the KVRs and, secondarily, on those villages adjacent to but outside of the KVRs. Additional selection criteria included:

- Accessibility
- Presence and variety of pastoral groups
- Size of livestock populations
- Diversity of economic activities
- Presence/absence of grazing areas

From a resulting list of the 25 seemingly most appropriate villages, 15 were selected in order to provide a representative spread across the study area (of which three villages were later substituted for specific reasons). The final selection comprised six villages in Kilombero District (Namawala, Mofu, Lukolongo, Chita, Mgugwe and Ngalamila), six in Malinyi (Ngoheranga, Tanga, Misegese, Ngombo, Njiwa and Namhanga) and three in Ulanga (Kivukoni, Igota and Lukande) (Table 2, Map1). Details of the selection process are outlined in Annex 4.

In each village an initial preparatory meeting was held with the Village Head, in order to explain about the study, to establish a date and location for the meeting, and to select village participants. Working from the village registers 40 participants were selected at random. The resulting list was then examined to identify livestock owners and, where necessary, some participants were

purposely substituted with pastoral members such that the resulting group included at least 10 livestock keeping households. Where appropriate, participants were refunded for transport costs incurred in getting to and from the meeting place. The actual number of participants for each village varied from 31 to 40 (Annex 5).

The core of the PRA study comprised a standard set of exercises that was implemented during one day in each village. Participants were split into four subgroups of 7-10 people, each under supervision of a facilitator and who was conversant in the relevant local languages. Three subgroups carried out specific pastoralism PRA exercises under the broad themes of:

- People, history, governance and conflicts
- Natural resources and livelihood activities
- Pastoralists and livestock management

Table 2. Selected villages for the PRA study.

S/no	Districts	Division	Ward	Village	Scores
1	Ulanga	Lukande	Lukande	Lukande	Not scored
2	Ulanga	Lupilo	Minepa	Kivukoni	0.8
3	Malinyi	Mtimbira	Iragua	Namhanga	1.0
4	Ulanga	Lupilo	Lupilo	Igota	1.0
5	Kilombero	Mngeta	Mchombe	Lukolongo	1.0
6	Kilombero	Mngeta	Chita	Chita	1.2
7	Malinyi	Malinyi	Malinyi	Misegese	1.2
8	Kilombero	Ifakara	Namwawala	Namawala	1.2
9	Malinyi	Malinyi	Ngoheranga	Ngoheranga	1.2
10	Malinyi	Malinyi	Njiwa	Njiwa	1.2
11	Kilombero	Milimba	Utengule	Ngalimila	1.5
12	Kilombero	Milimba	Kamwene	Mgugwe	1.3
13	Kilombero	Mngeta	Mofu	Mofu	1.3
14	Malinyi	Malinyi	Ngoheranga	Tanga	1.2
15	Malinyi	Malinyi	Biro	Old Ngombo (Biro, Mbalinyi and Ngombo)	1.5

Key



Primary zone



Secondary zone

The fourth subgroup gathered data on fishing activities, as part of the fisheries diagnostic study that was carried out in parallel with the pastoralism study. All results were recorded on flipcharts in Swahili. Details of the pastoralism PRA exercises are provided in Annex 6. Sampling was carried out during July 2016 (Annex 7).

The PRA exercises were complemented by a series of Key Informant Interviews (KIIs) carried out concurrently with the PRA exercise. The KIIs were targeted at three groups: village leaders, pastoral elders and participants in the cattle meat value chain (butchers, owners of bars and restaurants and institutions). Specific lists of questions were developed and administered to respondents in each of these groups (Annex 8). A total of 15 KIIs were implemented with village leaders and pastoralist elders, and another 23 with various participants in the cattle meat value chain.

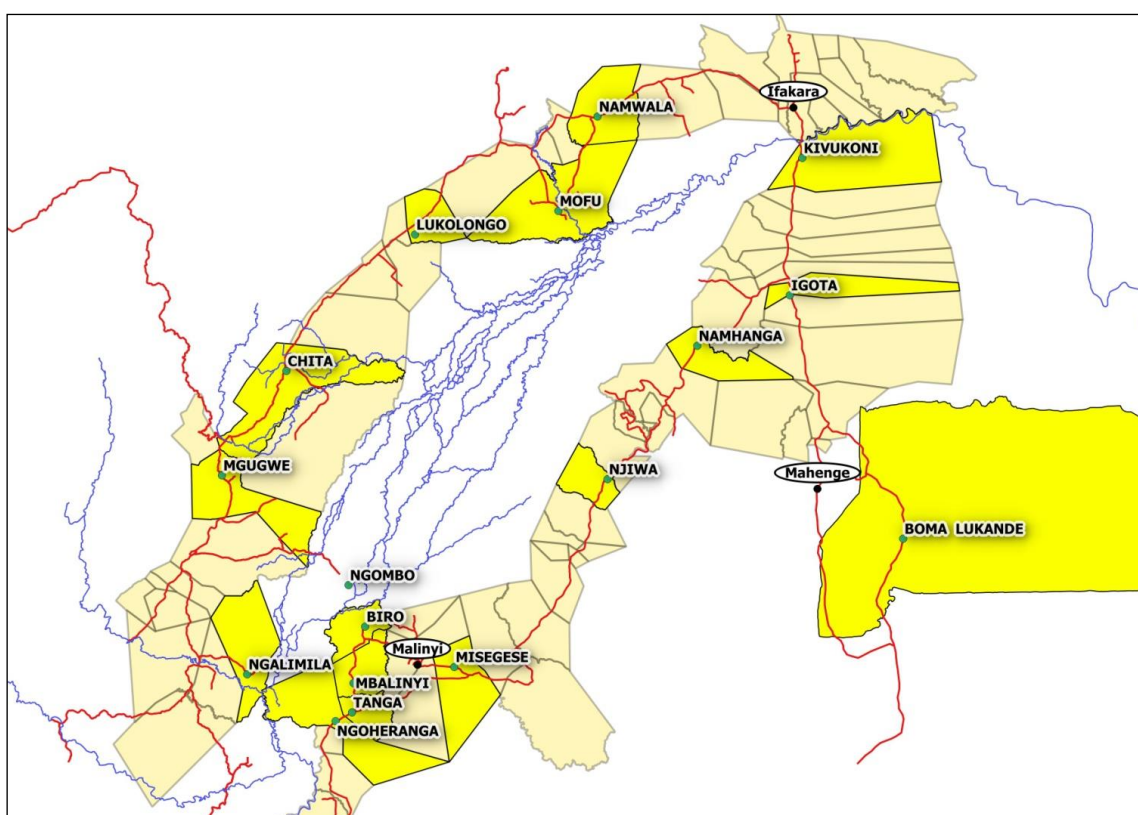
For the HHQ a tablet based system was used for collecting data. A specialist consultant (Collins Mwange from Geoeng Systems, Nairobi) was engaged for this component: to advise on which tablets to use, to upload the questionnaire into the tablets, to train enumerators in use of the tablets

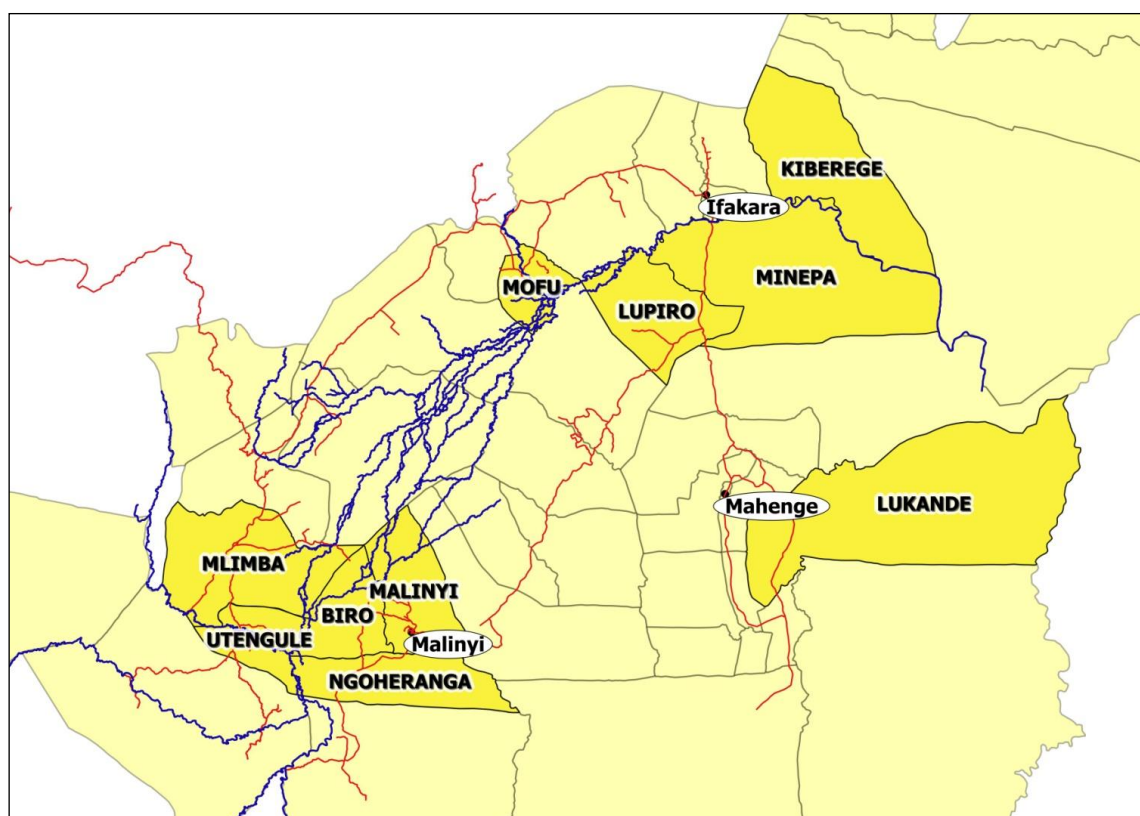
and the data collection system, to oversee initial data collection and, afterwards, development of the database. Initial training took place during the week 15-21 August.

A total of 300 questionnaires were completed, comprising 30 from each of 10 sample clusters. Each cluster included respondents from between 3 and 5 villages within a certain ward (Map 1, Table 2). The questionnaire was specifically targeted at livestock producers, who were identified by village leaders and selected at random from the resulting lists. Respondents were requested to come into a central point on a specific day to answer the questionnaire. Data was collected by nine enumerators during the period 28 August to 25 September.

Map 1. Location of the 15 villages selected for the PRA study.

(Note: a). Mbalinyi, Biro and Ngombo (not shaded) were treated as one village “Ngombo”, corresponding to the “old” Ngombo. b). The boundary depicted for Lukande is the ward boundary rather than for the village.)



Map 2. Location of the 10 wards selected for the HHQ survey.

The questionnaire (Annex 9) comprised 90 questions grouped under six sections:

Section A: Respondent details and household characteristics

Section B: Socio-economic activities

Section C: Livestock keeping (cattle, goats and sheep)

Section D: Inputs to production (breeding, grazing resources, water resources, health care, infrastructure, equipment, finance, labour, information and knowledge)

Section E: Products and marketing (meat, milk, dung, animal power, money)

Section F: Conflicts, challenges and trends

The resulting data was entered into a single matrix comprising 1170 variables by 300 respondents and made available in Excel, SPSS and STATA formats. The bulk of analyses were carried out using SPSS. Analyses were mainly confined to simple descriptive measures, including frequencies and measures of central tendencies (ranges, modes and means).

3 RESULTS

Detailed results of the PRA studies are presented in two stand alone reports, comprising the main PRA results (Annex 10) and the results of KIIs concerning livestock markets and the cattle meat chain within the study area (Annex11). In this report summary results, together with those of the HHQ survey, are presented in an integrated fashion.

3.1. PASTORALISTS AND LIVELIHOODS

3.1.1 History

The Kilombero valley has a long history of in-migration and settlement. The Ndamba (fishermen) and Pogoro (small farmers) are generally acknowledged as the oldest residents and, together with the Mbunga, are considered as natives to the Kilombero Valley. Other relatively early and prominent immigrant groups include the Bena, Ngindo, Ngoni and Hehe.

The arrival of Barbaig, Maasai and Sukuma pastoralists is more recent. Of the HHQ pastoral respondents, a few arrived in the Kilombero Valley in the 1950's and 1960's. Low levels of in-migration continued during the 1970's and 1980's and then increased greatly during the 1990's and 2000's. Although the present decade is not complete, the existing data suggests declining levels of in-migration as compared to the previous decade.

Within the 15 PRA study villages, the first pastoralist arrivals were Barbaigs in the 1970's, followed by Maasai families who settled in various villages from 1977 to 1999, and Sukumas who arrived in different villages from 1977 to 2008. The in-migration of pastoralists continued at a slow pace until about 2000, following which there was a huge influx of Sukumas through to about 2008. PRA participants noted a pattern of displacement whereby in any particular area Barbaig immigrants were often the first settlers, then when Maasai arrived the Barbaig families would often move on and, likewise, once Sukumas started to arrive the Maasai would often move to other areas.

PRA participants reported that Barbaigs had mainly come from Manyara, Dodoma, Mbeya and Songea Regions; Maasai from Mbeya, Iringa and Arusha Regions and Sukumas from Shinyanga, Mwanza, Tabora, Sumbawanga, and Mbeya Regions. Among the HHQ respondents, Barbaigs came mainly from Hanang District (61.1%) and the balance from seven other districts (one respondent or 5.6% each); Maasai came predominantly from Kilosa District (50.0%) plus 5.9% each from Iringa, Kilombero and Kiteto Districts; and Sukumas came from many different districts, including Bariadi, Shinyanga and Tabora Districts (each 7.6%), Igunga, Masawa and Nzega (each 6.4%), Kwimba (5.2%) and the remaining 52.8% from a wide number of other districts.

Only 16% of HHQ respondents were born in the village where they presently live, and these were mainly members of other resident (non pastoralist) tribes (53.9%). No Barbaig (0.0%) and very few Sukumas (2.3%) or Maasai (8.8%) respondents were born in the villages where they presently reside. Note that in this report where reference is made to "other tribes", this refers to the remaining 76 questionnaire respondents that were from other tribes than the main pastoral groups of Sukumas, Maasais and Barbaigs.

The main reason for pastoralist immigrants moving to the Kilombero Valley was in search for grazing pastures for their livestock, particularly for the Barbaig and Maasai. However, Sukumas are often agro-pastoralists and were also looking for arable land for cultivation; for some Sukumas cultivation were reported to be the prevailing reason rather than searching for livestock pastures. Subsequently, as a result of the huge expansions of farming activities practiced by Sukumas, many Barbaigs and Maasai were reported to have started to emigrate again to look for other grazing areas outside of the valley.

There were also “push” factors that stimulated the pastoralists to leave their former areas of settlement. PRA respondents reported that Sukumas decided to leave their former areas as it was too dry for them to undertake pastoralism and cultivation. Likewise, Maasai and Barbaigs were stimulated to leave their areas of origins due to population increase, changes in livelihood and loss of land to investors and conservation areas.

Before moving to the Kilombero Valley pastoralists would typically do an initial survey to identify the best potential rangelands for their livestock and, for Sukumas, also fields for cultivation. According to key informants, on arrival, they first reported to the village authority and requested for village residence and then registered as a village member. However, in Mofu village it was reported that there are number of pastoralists who did not register in village, these being mostly Sukumas who were brought here by their relatives and a few Barbaigs. It was reported that after registering, pastoralists were given a piece of land according to their request, or even that they were able to take as much land as they wanted. The registration process was reported to be free of charge in most but not all study villages. More recently, particularly since the 2012/2013 eviction exercise, it appears that some pastoralists are migrating into the Kilombero Valley without registering in any village.

Initially people in the Kilombero Valley did not live in villages. Some villages are relatively old, such as Ngombo (1880), Mofu and Tanga (both established in 1910), Ngoheranga (between 1920 and 1930), and Namuhanga (1930). However, most villages (9 out of 15) were established between 1967 and 1977, principally in response to the Arusha declaration of 1967 which highlighted the need for scattered households to be resettled into designated villages. The most recently established village was Lukolongo, in 1999. As populations continue to grow, new villages continue to be established through subdivision of existing villages into new entities, as has been the case for Ngombo (from which the villages of Biro and Mbalinyi have been excised) and recently for Malinyi District (created through subdivision of Ulanga District).

All villages comprised a mix of tribes, varying in number from three to 13 per village. Sukuma were identified from all 15 PRA villages. The next most frequent tribes were Ndamba (n=11), followed by Barbaig and Bena (n=7 each), then Pogolo (n=6), Hehe (n=5), and Nyaturu and Maasai (n=4 each). The remaining 17 tribes were identified from three or fewer villages. Of the eight villages for which proportions were scored, Sukumas were dominant in three villages, Ndamba in two and Bena, Hehe and Pogoro in one each. Barbaig and Maasai were not recorded from any of these villages.

The HHQ was specifically targeted at cattle keepers. Eight of the ten sample wards were dominated by Sukuma respondents, other than Kiberege which was dominated by Maasai and Malinyi by members of other tribes. Similarly, Sukuma respondents were included in all 10 wards, members of other tribes in nine wards (absent from Lukande, but where sampling was specifically biased towards Barbaig families), Barbaig in seven wards and Maasai in six wards. In addition to the three main pastoral groups, 20 other tribes were recorded among the 76 questionnaires administered to other livestock keepers, of which the most frequent were Ndamba (n=19 respondents), Bena (n=13), Ngoni (n=10) and Pogoro (n=6).

3.1.2 Historical events

The types of historical events that have shaped the history of the Kilombero Valley, as reported by PRA participants, included:

- Wars (Sulia Mbingu and Kagera);
- National events (death of Sokoine, introduction of multi party political system, Loliondogate scandal, debt clearing, privatization, national census);
- Establishment, changes to and development of villages (including operation Sogeza (programme of settling in villages), subdivision/partition of villages, loss of village land to KVTC and KQRS, and construction of schools and clinics);
- Movements of people (in-migration/arrival of pastoralists, operation Tokomeza/eviction of pastoralists);
- Extreme climatic events (floods, too sunny, droughts);
- Losses of crops to pests (caterpillars, locusts, rats, diseases);
- Conflicts with wildlife (elephants and lions);
- Diseases (cholera, meningitis diarrhoea, lack of medicines); and
- Conflicts (Maasai stole cattle; rumours of blood suckers, political conflicts, confiscation/eviction of cattle, land taken by immigrants, conflicts with pastoralists, conflicts between farmers and pastoralists and seasonal land invasions).

Persistent events, recorded from more than one presidential era, were floods and droughts (n=4 eras each), caterpillars (n=3), famine, elephants, lions, in-migration of pastoralists, eviction of pastoralists and cholera (n=2 each). Mentions of wildlife date to the Nyerere, Mwinyi and Mkapa eras but were not mentioned during the more recent Kikwete era.

The common and key events recalled during the Nyerere era were flooding (n=7 villages) which occurred in 1974-1979 and operation Sogeza (n=6) which occurred in 1974-1977. Elnino floods (1997/98) was the most frequently noted event during the Mkapa era (n=11 villages). The invasion of crops by caterpillars was reported from Igota and Mofu villages in 1997 and 2004 respectively. Drought and crop raiding (2005-15), pastoralist's immigration to the valley (2005) and operation Tokomeza (2013) were the key events recalled by participants from more than one village during the Kikwete era.

3.1.3 Household composition

Among the HHQ sample, family sizes ranged from 2-69 members, with a median value of 10 and a mean value of 12.6. Differences between ethnic groups were not marked; mean sizes for Barbaig (12.1 individuals) and Maasai (11.7) were similar, whilst members of other tribes (the balance of the sample of livestock keepers) had slightly smaller families (8.4 members) and Sukumas slightly larger families (14.7 members).

The division between males and females was roughly equal, with overall median values of five each, and mean values of 6.2 males and 6.5 females, per family.

Overall the number of children per family ranged from 0-27, with a median value of five per family and a mean value of 6.7. Comparing between tribes, the pattern of numbers of children was consistent with that of overall family sizes, being lowest for other tribes (4.4 children), intermediate for Maasai (6.1) and Barbaig (7.0) and highest for Sukumas (7.8). Other dependents ranged from 0-40 per household, with a median value of two and a mean of 3.4 per household.

Thus, the average family comprised 12.6 people, of which 6.7 were children and 3.4 other dependents, leaving a balance of 2.5 other family members.

3.1.4 Education

Levels of education amongst pastoralists were low. Overall 46.0% of HHQ respondents had no education (mainly pastoralists), 48.3% some primary education and only 5.3% some secondary education, with just one respondent (0.3%) having attended higher education. Differences in education between tribal groups were marked. Thus 93.4% of other tribes had some education, versus 46.7% for Sukumas, 29.4% for Maasai and 5.6% for Barbaigs.

3.1.5 Structure of houses

The number of rooms per house varied overall from 1-28, with a median value of five and a mean value of 6.1, varying from 5.0 for other tribes to 6.7 for Maasai. Types of housing materials showed considerable differences between tribes. Maasai and Barbaig had predominantly mud and pole houses (67.6% and 55.6% of respondents respectively), with few brick houses (11.7% and 5.6% respectively). Sukuma were intermediate with 58.1% having brick houses and 35.3% mud and pole houses, whilst livestock keepers of other tribes had houses built mainly of bricks (77.6%) and only 15.8% of mud and poles. The balance of houses, in all cases, was made up of houses constructed from wooden planks, reeds or grass, and tin sheets, which collectively comprised 38.9% of houses for Barbaig, 20.5% for Maasai, 10.1% for other tribes and 6.4% for Sukumas. Similarly, in terms of roof materials, Maasai and Barbaig had houses predominantly with grass roofs (91.2% and 88.9% respectively); other tribes mainly used metal sheets (71.1%) and Sukumas were in between with 63.4% having grass roofs and 36.6% tin roofs. For Maasai and Barbaigs, floors were made from earth (100% each), whilst for Sukumas 12.2% had cement floors and rising to 31.6% of houses for other tribes.

3.1.6 Livelihood activities

A total of 19 livelihood activities were reported from nine PRA villages. The most common livelihood activities were crop farming and livestock keeping (n=9 villages each). For the seven villages for which scores were provided, crop farming was rated as being the most important activity in six villages, and in Lukande livestock production (where only Barbaigs were called for interviews and discussions). Other relatively common activities were running a small business (n=7 villages), fishing (n=6) and charcoal making/selling (n=4), followed by brewing beer, providing transport, formal employment, making bricks, running a restaurant and selling firewood (n=3 villages each).

Rice and maize were the most frequently identified crops, and were grown in all nine villages assessed. Of these, rice was rated as being most important in six villages, rice and maize jointly in two villages and maize in the final village (Lukande which is located in the uplands away from the floodplain, and only Barbaig informants). Other frequent and relatively important crops were sesame (simsim), cassava, sweet potatoes, bananas, ground nuts and sugarcane. Other crops (n=14 types) were identified from only four villages or less and consistently scored at less than 10% of the overall relative importance.

Among HHQ respondents, in addition to livestock keeping, virtually all households also carried out some crop farming (97.7%). Only 1.7% of respondents claimed to carry out fishing. Running a business was very low for Barbaig and Maasai respondents (5.6% and 5.9% respectively), rising to 12.2% for Sukumas and 25.0% for other tribes. Only eight respondents (2.7%) reported income from other activities.

When asked to identify their main occupation, HHQ respondents noted four main occupations: livestock production, crop farming, combined livestock and crop production and business. The most frequent response was combined livestock production and crop farming (39.0%), followed by livestock production (35.0%) and crop production (25.3%).

Differences between tribes were marked. Respondents from other tribes had the lowest number of livestock producers (14.5%), 39.5% mixed producers, and the highest number of crop producers (43.4%). Sukumas were intermediate with 34.3% livestock producers, 41.3% mixed producers, and 24.4% crop farmers. Maasai and Barbaig were dominated by livestock producers (61.8% and 77.8% respectively), with 38.2% and 16.7% respectively of mixed producers, plus for Barbaig a single crop farmer (5.6% = one respondent). Thus despite specifically targeting livestock keepers, one quarter of all respondents considered crop farming to be their primary activity. Among the main pastoral groups roughly one third (31.3%) remain as “pure” pastoralists (livestock keepers only) and the other two thirds also engage in crop farming.

Including the combined category, the overall proportion of livestock keepers was 74.0% and crop producers 64.3%. Livestock producers varied from 54.0% for other tribes to 75.6% for Sukumas, to 94.5% for Barbaig and 100.0% for Maasai. Similarly, crop producers varied from 22.3% for Barbaig to 38.2% for Maasai to 65.7% for Sukumas and 82.9% for other tribes.

Whilst these results are broadly consistent with traditional perceptions of Barbaig and Maasai being solely livestock keepers, Sukumas being both livestock keepers and farmers and native tribes being principally crop farmers, they also suggest that this pattern is not so clear cut.

3.1.7 Land ownership and use

Overall, most respondents owned land in their village of residence (94.7%). Frequencies were similar for Sukumas (97.1%), Maasai (94.1%) and other tribes (97.4%), but lower for Barbaigs (61.1%). The size of reported land holdings varied from 1-300 acres, with a median value of 20 acres and a mean value of 36.7 acres, the mean varying from 16.0 for Maasai to 16.4 for other tribes to 41.4 for Barbaig and 42.8 for Sukumas (one outlier value of 4,136 acres for Maasai was removed).

Just under one third of respondents (31.3%) reported renting land, varying from 28.5% for Sukumas to 31.6% for other tribes, to 33.6% for Barbaigs and 44.1% for Maasai. Size of rented land was smaller than owned land, ranging from 1-70 acres with a mean value of 7.1 acres, varying from 3.3 for Maasai to 9.1 for Sukumas.

Land was predominantly used for both crops and livestock (64.3%), or else for crops (31.3%), and rarely only for livestock (3.3%) or for other activities (1.0%). There were some differences between tribes; more Barbaigs use land just for crops (55.6%) than members of other tribes, and for Maasai fewer households use land just for crops (14.7%) and more just for livestock (23.5%).

3.1.8 Income and expenditure

HHQ respondents were asked to estimate annual income. Overall reported total income (n=300 families) was 3,607 million TZS. Of this 58.1% was derived from livestock (2,095 million TZS), 39.0% from crop production (1,406 million TZS), 2.0% from business activities (72.2 million TZS) and 0.9% from other activities (33.5 million TZS). Not everyone carried out all activities. Thus mean income per producer for livestock (n=298) was 7.03 million TZS, for crop production (n=293) 4.80 million TZS, for business (n=41) 1.68 million TZS and for other activities (n=8) 4.18 million TZS.

Differences in income between the main tribal groups were marked. Mean household income from livestock (per producer) for other tribes was 1.0 million TZS, for Maasai 4.8 million TZS, for Barbaig 5.2 million TZS and for Sukumas 10.0 million TZS. The pattern was reversed for crop production; mean household income (per producer) for Maasai was 0.8 million TZS, for Barbaig 1.9 million

TZS, for Sukuma 5.1 million TZS and for other tribes 6.3 million TZS. In other words Maasai and Barbaigs derive the bulk of their income from livestock, with some supplementary income from crops and business, whilst other tribes derive their principal income from crops supplemented by earnings from livestock and business. Sukumas occupy an intermediary position earning their major income from livestock, but with additional significant income from crops, plus some from business. The overall result is that mean household income was markedly higher for Sukumas (15.6 million TZS), than for other tribes (7.9 million TZS), Barbaig (6.9 million TZS) or Maasai (5.6 million TZS).

Twenty items of expenditure were reported. The most frequent ones were for livestock production (76.0% of respondents), health expenses (61.7%), crop production (58.3%), clothes (36.7%), food (31.3%), construction (19.3%), school fees (16.7%), transport (14.3%) and ceremonies/ festivities (6.3%).

Means amounts spent per item were highest for construction (1,811,000 TZS) and school fees (1,134,000 TZS), followed by crop production (942,000 TZS) and food (908,000 TZS), then livestock (751,000 TZS), ceremonies/festivities (742,000 TZS), health (452,000 TZS), clothes (430,000 TZS) and transport (387,000 TZS). Other occasional items of expenditure with high amounts were buying land (3,070,000 TZS), motorcycles (1,900,000 TZS), paying fines (1,420,000 TZS), purchasing drink (431,000 TZS) and furniture (408,000 TZS) and paying taxes (241,000 TZS). Other occasional items were registration fees, milling fees, electricity bills, bride price and the lending of money.

Overall total reported expenditure was 776 million TZS. Of this 22.1% was on livestock production, 21.3% on crop production, 13.5% on construction, 11.0% on food, 10.8% on health, 7.3% on school fees, 6.1% on clothes, plus 7.9% on other items. Unlike for income, differences in expenditure between the main tribal groups were relatively small. Mean household expenditure was 2.6 million TZS, varying from 2.0 million TZS for Maasai, to 2.2 million TZS for Barbaig, to 2.7 million TZS for Sukuma and other tribes.

There were differences in what different groups spend money on. Barbaigs, Maasai and Sukumas invest more in livestock than other tribes, whilst the pattern is reversed for crops. Similarly, Sukumas and other tribes spend more on construction and school fees than the Maasai and Barbaigs – in fact Barbaigs did not report any spending on construction or school fees. Despite investing in crops, other tribes spend more on food than the pastoral groups, but less on health and clothes. Ceremonies appear more important for the pastoral groups than the other tribes. Other tribes also spend less on transport.

3.1.9 Wealth ranking

Different levels of wealth were noted by participants in all PRA villages, namely poor, medium and rich households, with poor households accounting for 70.9%, medium 24.5% and rich 5.3% of overall respondents. In nearly all villages (other than Lukande) the majority of households were estimated to fall within the low income category (ranging from 55% in Namawala to 80% in Mgugwe, Igota and Kivukoni); for Lukande the middle income class was estimated to comprise the majority (55%).

3.1.10 Variation between wealth groups

Families in different wealth categories were noted to differ in terms of types of houses, household assets, size of farms, method of tillage, numbers of livestock, types of fishing gear used and annual income. Interestingly, no differences were identified in terms of education.

Low income households were characterised by having poor quality houses (grass roofs and mud walls); having limited household assets (mobile phone and radio, a few with bicycles); small fields (up to 3 acres); using hand hoes for cultivation; having no livestock or just a few animals; most fishing being done with hooks; and annual income being relatively low (500,000-5,000,000 TZS).

3.1.11 Development priorities

The most frequently identified development priorities by PRA participants were for roads, water supplies and hospitals (n=13 villages each). Other common development priorities were schools (n=10), markets (n=8), electricity (n= 5), school teachers and farms inputs (n=3 each), followed by sustainable agriculture, village offices, dip tanks, irrigation schemes and police posts each of which were identified in two villages. These factors reflect the existing limited level of physical development in the Kilombero Valley in general, with roads and water being the most immediate developments needs.

3.2 LIVESTOCK AND LIVESTOCK KEEPING

3.2.1 Initiation of livestock keeping

The most common way of starting livestock keeping, overall, was through the purchase of livestock (66.3% of HHQ respondents), followed by inheritance (41.3%). Other methods included through loans and dowry/bride price (2.7% each), plus help from friends or relatives (1.0%), and for one respondent through a heifer project (0.3%). These results varied between ethnic groups. For Sukumas (68.0%) and other tribes (92.1%) the most common method was purchases, whilst for Barbaig (72.2%) and Maasai (91.2%) inheritance was the principal route.

3.2.2 Period of livestock keeping

Barbaig, Maasai and Sukuma HHQ respondents have typically been keeping livestock for much longer periods than respondents from other tribes; respective mean periods were 26.9 years, 26.7 years, 23.2 years and 8.0 years. The bulk of other tribes have thus only started keeping cattle since 2000 and particularly during the present decade.

And whereas most respondents from other tribes initiated livestock keeping in the Kilombero Valley in their present village of residence (93.8%), for the main pastoral groups only one third started inside the Kilombero Valley (30.6% for Sukumas, 33.3% for Barbaigs and 35.3% for Maasai), and the balance started elsewhere outside of the Kilombero Valley. Of those who started livestock rearing in the Kilombero Valley, few have moved elsewhere in the Kilombero Valley (9.3%) and these are all Barbaigs, Maasai or Sukumas. Of those who started livestock keeping elsewhere outside the Kilombero Valley, once arriving within the Kilombero Valley most have remained in their initial village of settlement, varying from 100% for other tribes, to 81.0% for Maasai, to 71.2% for Sukumas to 33.3% for Barbaigs.

3.2.3 Types of livestock

For the HHQ respondents, the most commonly kept animals were cattle (99.7% of households), followed by chickens (71.0%), then sheep (67.3%) and goats (58.7%), with a few households reporting the presence of donkeys (4.0%), ducks (2.7%), dogs (1.3%), pigs (1.0%), plus pigeons and cats (0.3% each). Considering sheep and goats, these were most frequent amongst Maasai

(94.1% and 88.2%, respectively), with slightly lower prevalence for Sukumas (76.7% and 65.7%) and Barbaigs (72.2% and 55.6%), but markedly lower for other tribes (32.9% and 30.3%). There was less variation in ownership of chickens, which varied from 67.1% for other tribes to 70.9% for Sukumas to 72.2% for Barbaigs to 79.4% for Maasai.

PRA respondents identified the same 11 types of livestock. Chickens, cattle, goats, and dog were reported to be present in all 15 villages; sheep and ducks in 14 villages; pigs and cats in 13 villages; donkeys in 10 and pigeons in 7 villages. In terms of abundance, the livestock community was estimated to be dominated by chickens (48.5%) and cattle (40.0%). However, the estimated abundance of different species varied widely from one village to another. Thus, the relative abundance of chickens ranged from 0.4% (Kivukoni village) to 84.7% (Mgugwe village) with cattle showing the reverse pattern (4.2% for Mgugwe and 85.9% for Kivukoni).

3.2.4 Livestock Importance

Within the pastoral groups of PRA participants, cattle were considered to be the most important livestock (72.3%), followed distantly by sheep (10.9%), goats (7.5%) and chickens (6.0%). Other types of livestock each accounted for less than 2% of the overall relative importance. The high importance allocated to cattle was mainly attributed to their role in cultivation and their market value.

HHQ respondents were asked to estimate the value of their livestock. Considering the four main species the overall estimated value was 15,901 million TZS; of this, cattle accounted for 95.6%, sheep 2.4%, goats 1.6% and chickens 0.4%. Estimated mean values per head were 1,007,553 TZS for cattle, 68,114 TZS for sheep, 56,010 TZS for goats and 8,298 TZS for chickens.

3.2.5 Numbers of animals per household

Numbers of animals, as reported by HHQ respondents, ranged widely between households as follows:

Cattle 2-700

Goats 0-250

Sheep 1-500

Chickens 3-408

For cattle the overall mean value was 50.5 per household, varying from 98.4 for Barbaig, to 60.2 for Sukumas, to 57.5 for Maasai and down to 14.6 for other tribes. This pattern of markedly lower numbers for other tribes was repeated for goats, sheep and chickens, as follows:

Goats, overall mean = 26.0, Maasai = 32.5, Barbaig = 27.5, Sukumas = 25.5, and other tribes = 19.9.

Sheep, overall mean = 28.1, Barbaig = 40.1, Sukumas = 29.8, Maasai = 26.8, and other tribes = 14.1.

Chickens, overall mean = 32.6, Sukumas = 41.1, Maasai = 25.3, Barbaigs = 19.5, and other tribes = 18.8.

For the 300 HHQ respondents, the overall cattle population was 15,087, of which 10,350 were owned by Sukuma, 1,956 by Maasai, 1,672 by Barbaig and 1,109 by members of other tribes. For other livestock the total populations were 5,650 sheep, 4,606 goats and 6,934 chickens.

3.2.6 Cattle breeds

Nine cattle breeds were recorded: Tarime/Mara, Pure Ankole, Natural/Maasai, Ankole, Kisasa, Borana, Mangati/Barbaig, Ugesera and Kisasa hybrid. The most frequently recorded breed was

Tarime/Mara (78.3% of respondents), followed by Natural/Maasai (28.3%) and Ankole (25.7%), then Kisasa (6.3%) and Pure Ankole (5.7%), Borana (2.0%) and others (5.3%). While Tarime breeds were reported to be preferred because they are fast growing and can be used as draft animals, Ankole are not used as draft animal but are characterized by growing fast, achieving a heavy weight and having good meat.

In terms of numbers of cattle, the overall the herd was dominated by Tarime/Mara 59.5%, followed by Natural/Maasai (20.4%) and Ankole (12.7%), with smaller numbers of Pure Ankole (1.3%), Kisasa (1.0%) and Borana (0.4%), and with others making up the final 4.7% (mainly Mangati/Barbaig).

The different groups of livestock keepers seem to prefer different breeds. Sukumas keep mainly Tarime/Mara (59.5%) with lesser amounts of Ankole (21.5%); Barbaigs keep mainly Natural/Maasai (58.3%) with lesser numbers of Tarime/Mara (20.8%); Maasai keep mainly Natural/Maasai (59.6%) with lesser frequencies of Tarime/Mara (17.3%) and Kisasa (15.4%); and other tribes keep mainly Tarime/Mara (55.2%) with lesser frequencies of Natural/Maasai (16.2%) and Ankole (15.2%). Overall the most frequent breed was Tarime/Mara (51.7%) with smaller representations of Natural/Maasai (18.7%) and Ankole (16.9%).

3.2.7 Herd sharing

Most families reported keeping their cattle in a single herd (88.3% of HHQ respondents), with the balance having two or more herds. This varied from 77.8% for Barbaigs to 85.3% for Maasai, 86.6% for Sukumas to 96.1% for others. For those families with multiple herds, the majority (80.0%) had two herds, whilst a small proportion of respondents reported three (17.1%) or four herds (2.9%). However, these results should be treated with caution as it is likely that they may have been influenced due to fears about possible future evictions.

Overall, 16.7% of households included animals from other people in their herds, varying from 14.5% for Sukumas, to 17.1% for other tribes, to 17.6% for Maasai, to 33.3% for Barbaigs. Usually (92.0%, or 46 cases) this concerned cattle, plus two cases each for goats and sheep. The number of cattle belonging to other people varied from 1-100, with an overall total of 510 cattle, giving a mean value of 10.4 per herd (for those herds that include additional animals). In general, the owners of these animals resided elsewhere in the Kilombero Valley in other villages.

On the other hand 15.3% of HHQ respondents reported keeping some animals in other herds, varying from 11.8% for other tribes and Maasai, to 16.3% for Sukumas to 27.8% for Barbaigs. Again virtually all of these cases were for cattle (91.3%) with a few instances of goats (6.5%) and one of sheep (2.2%). Collectively this amounted to a total of 1,058 cattle managed elsewhere, with a mean number of 23.0 per herd (and a range of 1-150 animals). Virtually all such cattle were reported to be kept elsewhere in Kilombero/Ulangu/Malinyi Districts, other than for four cases (two in Kilosa and one each for Kibaha and Bagamoyo).

3.2.8 Cattle herd composition

The overall herd was made up of 5,868 cows, 3,198 calves, 2,604 heifers, 2,387 steers and 1,005 bulls. Thus the average herd of 50.4 animals (across all 300 HHQ respondents) comprised 3.4 bulls, 8.0 steers, 19.6 cows, 8.7 heifers and 10.7 calves.

Steers were most frequently owned (89.3% of respondents), followed by cows (86.7%), then bulls (82.0%), then calves (79.0%) and heifers (68.0%). Mean numbers of different types of animals varied between tribes in accordance with differences in mean herd sizes.

3.2.9 Growth of cattle herds

PRA participants noted that the Kilombero Valley provides excellent conditions for livestock keeping. Overall 89.3% of HHQ respondents reported growth of their herds during the last 12 months, principally due to natural reproduction (76.7%) or purchases (29.3%), plus minor occurrences of gifts (2.7%), receipt through dowry (1.3%), or animals gained through exchanges (0.7%) or borrowing (0.3%). In terms of actual numbers, the reported growth was of 4,257 animals, comprising 3,608 through natural reproduction, 394 through purchases and 255 through other means.

3.2.10 Offtake and losses of cattle

Roughly two thirds of respondents (63.3%) reported offtake or losses of animals over the previous 12 months. The most common causes of reduction were due to sales (45.3%), deaths (30.7%) and own use (13.0%), followed by other reasons (5.3%), gifts (5.0%), theft (1.7%) and barter (0.7%). Other causes included animals provided as bride price (4.7%), plus one case each of animals being confiscated and being eaten by a lion. In terms of actual numbers, this equated to the removal of a total of 2,049 animals, of which sales accounted for 1,075 animals, deaths 404, slaughter 83 and other causes 487 head (bride price = 192, gifts = 160, theft = 109 and others = 26).

Comparing losses (2,049 head) and gains (4,257 head), this suggests an overall increase of 2,208 cattle during the last 12 months, which equates to an annual rate of increase of 17.1% (from 12,879 to 15,087 head). Or, if one considers only natural reproduction (3,608 head) versus offtake through sales, deaths, own use and theft (total of 1,671 head), this suggests an overall increase of 1,937 animals, which equates to an annual rate of increase of 14.7% (from 13,150 to 15,087 head).

3.2.11 Causes of cattle deaths

The most frequently reported causes of cattle deaths were diseases (n=86 respondents), accidents (n=18), losses to predators (n=13) and other causes (n=7). The most frequently reported diseases were Contagious Bovine Pleuro Pneumonia (n=25), lung disease/coughing (n=9), foot and mouth disease (n=7), lumpy skin disease (n=6), unknown disease (n=6), ndigana (n=5), trypanosomiasis (n=4), East Coast fever (n=3), ndorobo (n=3), anaplasmosis (n=2) and ndui (n=2), plus 14 single cases of other diseases. Accidents were made up of birth complications, eating plastic bags and snake bites (n= 4 each), plus fighting with other cattle and falling in a well (n=2 each), and leg injury and deliberate injury by farmers (n=1 each). Other causes of losses were due to hunger (n=4), "over-ploughing" (n=2) and castration (n=1).

3.3 Inputs to livestock production

3.3.1 Requirements for keeping cattle

PRA participants identified nine requirements for raising cattle. Key inputs identified across all 15 villages were for grazing areas, water sources, veterinary supplies, extension services, plunge dips and, in 14 villages, markets. Other less frequently identified needs were for good breeds of cattle (n=3 villages), ropes to tie cattle, and cattle associations (one village each). Grazing areas (58.0%) and water resources (27.5%) were seen as the key requirements, collectively accounting for 85.5% of the overall relative importance. These were followed distantly by veterinary supplies (6.8%), extension services (3.2%) and plunge dips (2.6%). The relative importance of grazing areas ranged from 29.4% (Igota village) to 98.7% (Lukolongo village), and for water resources from 0.5% for Chita village and 1% for Lukolongo to 58.9% for Igota village. The lower importance values attached to livestock extension services and plunge dips is likely due to the prevailing culture whereby pastoralists have long experience of buying their own medicines and treating their livestock locally without any help from experts.

3.3.2 Grazing patterns

Grazing patterns were reported to be centred within the villages but to vary seasonally. During the rainy season (January to June) pastoralists from all study villages graze their livestock within the village. Specifically, respondents from ten villages reported grazing their livestock in the settled/reserved portion of their farmlands. These are parts of farmland specifically set aside for grazing pastures during the rainy season, the size of which varies according to the size of the farm and the number of livestock. Such areas may be set by an individual or in collaboration with neighbours. Respondents from three other villages grazed their livestock in village open areas (Lukande); in areas between/along the farm lands (Tanga); or open areas along the roads (Chita). Three villages (Ngalimila, Kivukoni and Biro/Mbalinyi/Ngombo) reported the presence and use of specific designated (settled) grazing areas, but claimed these were not large enough. Large pastoralists from Namawala, Namuhanga and Kisegese village also graze animals within the KGCA and, for Chita, move their cattle to nearby Merera village, which has a designated grazing area with relatively abundant pastures.

During the dry season (July to December) most pastoralists continue to graze their animals within the village, mainly feeding on crop residues in farmlands (n=14 villages). Large pastoralists from the eight villages of Ngalimila, Chita, Kivukoni, Ngoheranga, Mbalinyi/Biro/Ngombo, Kisegese, Njiwa and Lukande, reported moving their cattle to graze in neighbouring villages as a result of scarce grazing pastures in their own village. Movements of cattle between villages are usually regulated by village governments, such that pastoralists need to request and to be accepted to graze in a particular village, although here this system was reported only for Chita, Kivukoni, Mbalinyi and Lukande villages. For Biro village (where Mbalinyi pastoralists move to during the dry season), whoever wants to graze in the designated village grazing area must pay a fee of TZS 10,000 per cattle head to the village government. This applies to both pastoralists who are resident within the village and those from outside (and who must first request permission to access grazing resources). Pastoralists from Ngombo and Ngoheranga villages put their animals to graze in specific lowland areas that flood during the rainy season such that they cannot be cultivated (known as "*Kipambata yalijuu*" and "*Lupunga*", respectively). Pastoralists from seven villages, namely Namawala, Ngalimila, Mofu, Namuhanga, Kisegese, Njiwa, and Ngombo, also graze animals within the KGCA during the dry season, while pastoralists from Kivukoni village graze animals within the ILUMA WMA.

Similar results were given by HHQ respondents who, in general, reported grazing cattle most frequently in lowlands in the village (67.3%), often extending into neighbouring villages (25.7%), or

within farmlands in the village (49.7%). Other less frequent areas used for grazing were elsewhere in the Kilombero Valley (6.3%), upland areas (12.7%) and others (1.3%). Differences between the rainy and dry seasons were not pronounced. During the rains there is lower use of the village (39.0% vs. 60.7%) and surrounding lowlands (18.3% vs. 23.0%), and increased use of farmlands (41.7% vs. 32.7%) and uplands (12.0% vs. 5.7%).

The majority of respondents (86.3%) reported grazing their cattle in the same place each year, with only 13.7% reporting moving elsewhere to search for other pastures. Reasons as to why some pastoralists move their cattle elsewhere, included inadequate pastures (n=25 respondents), specifically during the dry season (n=5), inadequate (water n=5), heavy rains/floods (n=5), no grazing areas (n=6), plus fires, government regulations and the Kilombero River (n=4 each).

Only one quarter of respondents (26.3%) considered grazing resources to be adequate. The response was lowest among Maasai (11.8%) and Barbaig (16.7%), intermediate for Sukuma (24.4%) and highest for other tribes (39.5%), mirroring the general pattern of Barbaig, Maasai and Sukumas generally having larger herds than members of other tribes. The wards for which grazing resources were most frequently rated as being inadequate were Kiberege and Utengule (93.3% each), followed by Minepa, Mlimba and Mofu (76.7% each), Malinyi (73.3%), Biro (66.7%), Lukande and Ngoheranga (63.3% each) and Lupiro (53.3%).

The most frequently mentioned constraints regarding grazing resources were a lack of designated grazing areas (40.7%); the fact that grazing areas are constrained by farming activities (34.3%); and encroachment by farmers into grazing areas (18.7%). Other less frequent responses were that there is a settled grazing area but with no infrastructure (6.0%) and others (grazing area not suitable or too small, and flooding of grazing areas, collectively = 6.7%).

3.3.3 Water resources

Sources of water for livestock were reported by PRA participants to also vary with season. During the rainy season pastoralist principally water their livestock in scattered rain water ponds, mainly within the village areas. Pastoralists from Chita and Kivukoni villages reported also watering their livestock in Mlumbaji (a natural water dam) and the Kilombero River, respectively (both located outside of the KGCA).

During the dry season, nearly all rain water ponds dry up and most pastoralists water their cattle in the Kilombero River and/or its tributaries, natural water dams, and constructed water ponds. The Kilombero River and their tributaries were reported to be the main source of water for livestock in 13 villages. Some of these rivers/tributaries are located inside the village and some within the KGCA. Pastoralists from Namawala, Namuhanga, Ngalimila, Mofu, Ngoheranga and Njiwa villages access water sources within the KGCA, whilst others from Lukolongo, Kisege, Njiwa, Tanga, Lukande and Kivukoni use tributaries of the Kilombero River located outside the KGCA. Natural dams provide another source of water for livestock during the dry season, specifically for pastoralists from Chita, Mofu, Lukolongo, Ngoheranga, Tanga and Mbalinyi villages. Again, some of these dams are within the KGCA, although most are outside. Six villages (Mgugwe, Ngalimila, Igota, Kisege, Njiwa and Mbalinyi) also access water for their livestock from constructed water ponds within their respective villages. Respondents from eight villages reported the use of water sources in neighbouring villages to which they move their cattle in search of pastures.

According to HHQ respondents, the principal water sources used for livestock are smaller rivers between settled areas and the Kilombero River (60.3%), scattered rain water points (52.0%), village residential areas (33.7%), the Kilombero River (12.0%), uplands (5.3%) and others (3.0%). There were marked differences between wards in terms of the relative importance of these different water

sources. Use of the Kilombero River was highest for Minepa (33.3%), Biro (23.3%), Malinyi (20.0%) and Ngoheranga (16.7%) and lowest for Mofu (0.0%), Kiberege, Lukande and Malimba (all 3.3%).

Comparing the wet and dry seasons, use of water sources in residential areas was much the same during both seasons (wet 22.3% and dry 25.3%). During the dry season other main water sources were small rivers between residential areas and the Kilombero River (56.0%), plus the Kilombero River (11.3%) and scattered rain points (9.0%). During the wet season the main sources were scattered pools (47.7%) and small rivers (29.0%) with little use of the Kilombero River (3.7%). In both seasons only limited use was made of upland areas (2.0% in the dry season and 4.7% during the wet season).

Unlike for grazing resources, the majority of respondents (77.7%) considered existing water sources to be generally adequate, with 22.4% expressing reservations. The highest rate of satisfaction was obtained for Lukande (93.3%), Minepa (90.0%), Biro and Ngoheranga (86.7%), Kiberege (83.3%), Malinyi and Mofu (73.3%), and the lowest rates for Lupiro and Utengule (66.7%) and Mlimba (56.7%).

For the rainy season, the most frequently mentioned problems concerning access to water resources (total of 53 responses) were stock routes to water points are narrow (n=18), water sources are surrounded by farming activities (n=17), restrictions to water in available water points (n=11), inadequate water points (n=4) and others (n=3). During the dry season the number of problems increased to 103 overall, the main factors being inadequate water points (n=29), restrictions to water in available water points (n=27), water sources surrounded by farming activities (n=20), stock routes to water points are narrow (n=20) and others (n=11).

3.3.4 Health care

Virtually all HHQ respondents (96.0%) reported administering some form of health care to their cattle during the previous 12 months. The main forms of care were spraying (83.3% of respondents), administering curative medicines (66.0%), deworming (54.7%) and vaccinating (42.7%). Dipping was mentioned by only 2.7% of respondents and others by 0.7% (salt licks and castration by one respondent each).

Provision of health care was overwhelmingly self-administered (94.0%), with limited support from government (5.9%) and a single case of a private veterinarian (0.1%). Government support was principally for vaccinations, accounting for 24.2% of all administered vaccines. Additional minor support was provided in terms of curative treatments (3.0%), deworming (3.1%) and spraying (0.4%). There was virtually no use of private vets, and no support was received from any NGO projects. Vaccinations were mainly given against trypanosomiasis (30.7%), contagious bovine pleura pneumonia (CBPP) (22.0%), worm infestations (17.7%), foot and mouth disease (12.7%), foot rot (11.0%), East Coast Fever (8.0%), anaplasmosis (5.3%), lumpy skin disease (4.0%), anthrax (3.7%), black quarter (1.3%) and others (5.0%).

3.3.5 Infrastructure

The most common livestock infrastructure within sample villages were markets (mentioned by 56.0% of HHQ respondents) and grazing areas (28.7%). There were very few or nil constructed watering points, no dip tanks, and no feed pens. Priority needs for future development were for additional grazing areas (88.7% of responses), followed by dip tanks (47.5%) and water points (34%). Markets (29.3%), improved roads (14.7%), fattening pens (3.7%) and other items (4.0%) were considered to be of lower priority.

3.3.6 Equipment

The most frequently owned items of livestock equipment were syringes (96.3% of HHQ respondents) and sprays (92.0%), followed by machetes (50.0%). Less frequently mentioned items were castrators (11.0%), arrows (9.3%), spears (8.3%), sticks (7.7%) and others (3.3%). Other items included ropes, axes, fencing, gum boots, knobkerries and guns. Most equipment was owned (87.4%) rather than borrowed (11.0%) or rented (1.6%). The most commonly borrowed items were castrators (n=69), sprays (n=24) and syringes (n=7). Priority items for future purchases were syringes (62.7%), spray tanks (56.3%) and castrators (44.3%).

3.3.7 Finance

The most frequently reported forms of livestock related expenditure over the last 12 months were for veterinary supplies (96.0% of HHQ respondents), followed distantly by the purchase of equipment (30.0%), purchase of new livestock (24.0%) and hiring of labour (13%). Less frequently reported items of expenditure were feed resources (8.3%), paying levies and taxes (3.7%) and other items (2.0%, e.g. fines and school fees).

Total expenditure for all 300 respondents came to 275 million TZS, which equates to a mean expenditure of 918,360 TZS per respondent. Nearly half of this was spent on veterinary supplies (46.6%), the next biggest item being the purchase of new livestock (29.9%). Smaller proportions were spent on hiring labour (8.6%), buying equipment (5.9%), buying food resources (3.7%), paying levies and taxes (3.7%) and other items (2.0%).

The most frequent sources of income (used to cover livestock expenses) were through the sale of crop products (50.1%) followed by sale of livestock (35.3%) and sale of livestock products (10.6%). The relative frequency of different sources of income varied markedly between tribes, with the sale of livestock being most frequent for Barbaigs (63.6%) and Maasai (67.4%), followed by sale of livestock products (18.2% and 23.9% respectively), whereas sales of crop products were most frequent for Sukumas (55.0%) and for other tribes (65.7%).

3.3.8 Labour

During the rainy season each HHQ household had a mean of 4.9 members engaged in livestock keeping, comprising 3.1 men and 1.8 women. Figures were lowest for other tribes (total of 2.8; consisting of 2.3 men and 0.5 women) and highest for Barbaigs (total of 6.8 people; 3.6 men and 3.3 women). Collectively, this equated to a total of 1,461 people for all 300 respondents, comprising 933 men and 528 women. There was very little in the way of seasonal variation, either overall or when broken down by tribes. The overall mean for the dry season was 4.8 people, comprising 3.1 men and 1.7 women.

Sales (94.9% of respondents) and slaughter of livestock for sale (100.0%) or food (94.7%) were carried out almost entirely by men. Herding and health treatment were predominantly carried out by men, but with a minority participation of women (17.3% and 13.0% respectively), and milking was shared equally between men (49.5%) and women (50.5%).

Nearly one quarter of respondents (23.7%) reported hiring some labour for livestock management activities during the last 12 months. Hiring of labour was most common for herding (23.7% of respondents), followed by milking (7.7%), for health treatment (6.3%) and other activities (5.0%, mainly slaughtering).

3.3.9 Information and knowledge

According to HHQ respondents, the main sources of information about livestock management were from family members (46.0%), from other livestock producers (41.3%), from extension agents (32.3%), village leadership (14.7%) and cellphones (13.0%). Other less frequently mentioned sources were radio (7.0%), community boards (6.0%), markets (5.7%), agrovets (5.3%) and television (3.3%). No mention was made of newspapers, internet or email. In terms of tribes, livestock keepers of other tribes rely less on family members (26.3% versus mean of 46.0%) and more on other livestock producers (59.2% versus mean of 41.3%).

Overall, 25.7% of respondents recalled being visited by an extension officer during the last 12 months. The response rate was highest for other tribes (39.4%) and lowest for Barbaigs (5.6%), with intermediate values for Sukumas (23.3%) and Maasai (17.6%). Of the 82 respondents who had been visited by an extension agent, almost one third (30.5%) reported a single visit, two thirds (64.6%) two visits, and a small minority (4.9%) three visits. The total numbers of reported visits were virtually the same during the wet and dry seasons (103 and 104 respectively).

3.3.10 Breeding strategies

Only 22% of HHQ respondents reported the practice of any breeding strategies. The main forms of breeding employed were:

- Controlled mating - best male from herd (11.3%)
- Purchase of high quality breeding male (6.0%)
- Castration of non-productive males (5.3%)
- Use of high quality male from neighbour or other source (2.7%)
- Cross breeding with male from neighbour or other source (2.7%)
- Exchange of high quality breeding males 2.0%

Breeding strategies were more frequently employed by the main pastoral tribes (Maasai 26.4%, Sukuma 25.0% and Barbaig 22.2%) than by members of other tribes (11.8%).

3.4 Livestock products and services

PRA participants identified 12 livestock products and 13 services. Milk (from cattle) and meat were the most important products accounting for 48.4% and 36.9% of overall importance, respectively, followed by chicken eggs (3.9%), manure (3.8%) and skins (2.7%). Other products included milk fat, rumen remains, blood, sheep fat, cattle horns, cattle hooves and urine. The most important services were the use of cattle for ploughing fields (48.9%) and the selling of animals to meet various household needs (16.1%), followed by use of animals for rituals (8.8%), food (5.6%) and dowry purposes (3.7%). Other services included the provision of transport and threshing by cattle, security by dogs and cats, and of cocks crowing in the morning.

Additional details concerning important products (milk, meat and manure) and services (traction and income) were obtained from HHQ respondents.

3.4.1 Milk

The majority of HHQ respondents (84.3%, n=253) reported milking cattle during the previous 12 months. Among these households, respondents milked between 1 and 209 animals per household, resulting in a collective total of 3,274 animals being milked, or a mean of 12.9 animals per milking

household per year. Cattle were milked for a period of between 2 and 12 months, with a median value of 6 months. Mean milk production per day per milking animal ranged from 0-40 litres, with an overall mean value of 2.7 litres per animal per day. This equates to a mean production of 17.4 litres of milk per household per day, or a total daily production of 4,405 litres.

A total of 251 respondents reported daily milk consumption ranging between 0-130 litres per household, with a median value of 6.0 litres and a mean of 13.2 litres per day. This suggests overall daily consumption of 3,318 litres per day.

A total of 211 respondents reported processing milk during the last 12 months. The amount processed per day ranged from 0-80 litres, with a median value of 2.5 litres and an overall mean of 7.9 litres, or daily total of 1,663 litres per day.

A total of 111 respondents reported selling milk during the last 12 months. For these families, the amount sold each day ranged from 0-65 litres, with a mean value of 13.1 litres, which equates to a daily total of 1,450 litres.

Milk was predominantly sold to relatives/neighbours (44.1%), or to private traders in local markets (38.7%). Less frequent were sales at local markets to consumers (9.9%), to private traders at district markets (5.4%), or to institutions (0.9%) or others (0.9%).

Prices obtained per litre ranged from 400-1,500 TZS with a median price of 1,000 TZS and a mean price of 896 TZS per litre. This equates to a mean daily income of 11,703 TZS per selling household (n=111) per day, or mean annual income of 4,271,595 TZS per household, or 474.15 million TZS overall. This income was reported to be predominantly controlled by the spouse (77.5%), or the head of household (18.9%), with the balance by some other family member (3.6%).

3.4.2 Meat

Overall, 73 respondents reported the slaughter of 132 cattle during the last 12 months. The estimated mean live weight of the animals slaughtered was 142.25 kg. Most animals were healthy at the time of slaughter (84.9%), with the remainder being either sick (9.6%) or injured (5.5%).

Of the 73 respondents, only nine reported sales of meat, ranging from 2-100% of the animals slaughtered, with a median value of 70%. The majority of sales were to neighbours or relatives, or to consumers or private traders in a local market. Total earnings from selling meat (n=8 respondents) were estimated at 7.1 million TZS, with a mean of 887,500 TZS per selling household. In all cases this revenue was reported to be controlled by the head of the house.

3.4.3 Manure

Just over one third of respondents (37.0%) reported the use of cattle dung during the last 12 months, all of whom used it for manure. Additional minor uses were for construction (8.9%), for fuel (5.7%) and for other purposes (4.1%), principally as a medicine but also a mosquito repellent. No sales were reported.

3.4.4 Draft power

One fifth of respondents (19.7%) reported the use of cattle for transport over the last 12 months for their own purposes, and a lower portion (7.3%) reported having used cattle to provide transport services for others. The earnings from providing transport ranged from 0-1.2 million TZS, with an overall total of 3.73 million TZS and a mean value of 170,000 TZS per provider (n=22 providers).

The use of cattle for ploughing was far more common, with 93.0% of respondents reporting the use of cattle to plough their own fields and 52.7% providing services to others. The earnings from this service ranged from 0-6.0 million TZS, with an overall total of 87.6 million TZS, and a mean income per provider of 554,222 TZS (n=158 providers).

3.4.5 Aggregate value of cattle

Records obtained from the three districts of Kilombero, Malinyi and Ulanga show that a total of 13,482 households are engaged in cattle keeping, the numbers of households being 5,652, 2,657 and 5,200 from Kilombero, Ulanga and Malinyi Districts respectively. Results from the 2012 national census indicate 94,856 households for Kilombero District and 54,123 for Ulanga District (including Malinyi), giving a total of 148,979 households. Combining these records this suggests that 9.0% of households in these districts keep cattle. However, the household data is from different sources and it is not clear that households have been defined in a consistent manner. Moreover, it is not clear that district records of numbers of cattle keepers are comprehensive and up to date.

Using the figure of 13,482 households for the three districts, it is possible to derive estimated total income per year derived through sales of live animals, milk, meat and transport and ploughing services. The resulting figures amount to 24.2 billion TZS for live sales, 21.3 billion TZS for milk, 3.9 billion TZS for ploughing, 0.3 billion TZS for meat and 0.2 billion TZS for transport and, collectively, to an overall total value of 49.9 billion TZS.

The actual value of livestock is much higher as this would include additional values such as subsistence production (e.g. consumption of milk and meat), inputs to other sectors (e.g. use of manure in fields and houses and traction services), as well as the downstream value of the red meat value chain.

3.4.6 Use of income

Overall, the most frequent sources of income earned from livestock were through ploughing (n=158), followed by milk (n=111), then transport (n=22) and meat (n=8). This analysis excluded live sales (n=136). In terms of income generation (again excluding live sales estimated at 645 million TZS), milk was the major earner (474.1 million TZS), followed by ploughing (87.6 million TZS), then meat (7.1 million TZS) and transport (3.7 million TZS).

The most frequent uses of income derived from livestock, during the rainy season, were for the purchase of veterinary products (73.7% of respondents), household health needs (56.0%), for farming activities (41.0%), for purchasing food (33.7%), for paying school fees (9.3%), for paying fines (5.7%) and for other issues (6.7%, including construction costs, hired labour, purchase of new livestock, milling services, clothes, for lending to others, for marking cattle, for bride price and for transport).

There was little difference in terms of use of income during the dry season, other than reduced use of income for farming activities, which was at 19.3% (vs. 41.0% during the rainy season).

PRA participants identified 18 reasons for selling livestock. All villages reported selling animals to pay for household health care, to pay for school fees, to build houses and to buy clothes. Other common reasons were to pay for cultivation costs and to pay for bride price (n=14 villages each). Livestock were also reported to be sold to purchase transport assets such as a bicycle, motorcycle or car (n=12), to pay for transportation fares and to buy food (n=10 each). Other reasons were to pay for fines (n=9), to buy veterinary inputs (n=6), and to pay for village development contributions

(n=5). Additional less frequent reasons were to purchase other animals, to buy a farm, to finance business operations, to assist friends or relatives and to pay for court cases. Family health care was rated as the most important reason (48.9% of overall relative importance), followed by school fees (16.0%) and payment of fines (10.6%). Other less important reasons were to buy veterinary inputs (2.4%), to purchase other cattle (1.3%) and to build houses (1.0%).

3.4.7 Local Cattle Meat Chain

Consumption of cattle meat was reported to be more significant than for other types of livestock. Figure 1 shows the local market channels of cattle from pastoralists to consumers in the district level. Most cattle are sourced from pastoralists through trading within the valley. While a few cases were reported of pastoralists selling their cattle directly to small/medium traders and/or brokers at their homes, most of the cattle were reported to be brought to auctions within the valley (Ulanga, Malinyi and Kilombero Districts).

It was often difficult to differentiate between brokers and traders as most perform both functions, serving as brokers if capital is limited and as traders if they can afford to purchase their own cattle. Small/medium traders were considered to concentrate on trading within and between the districts, and large traders were reported to trade beyond the district level. In this respect butchers are important small/medium traders as they buy live animals for slaughter within the valley.

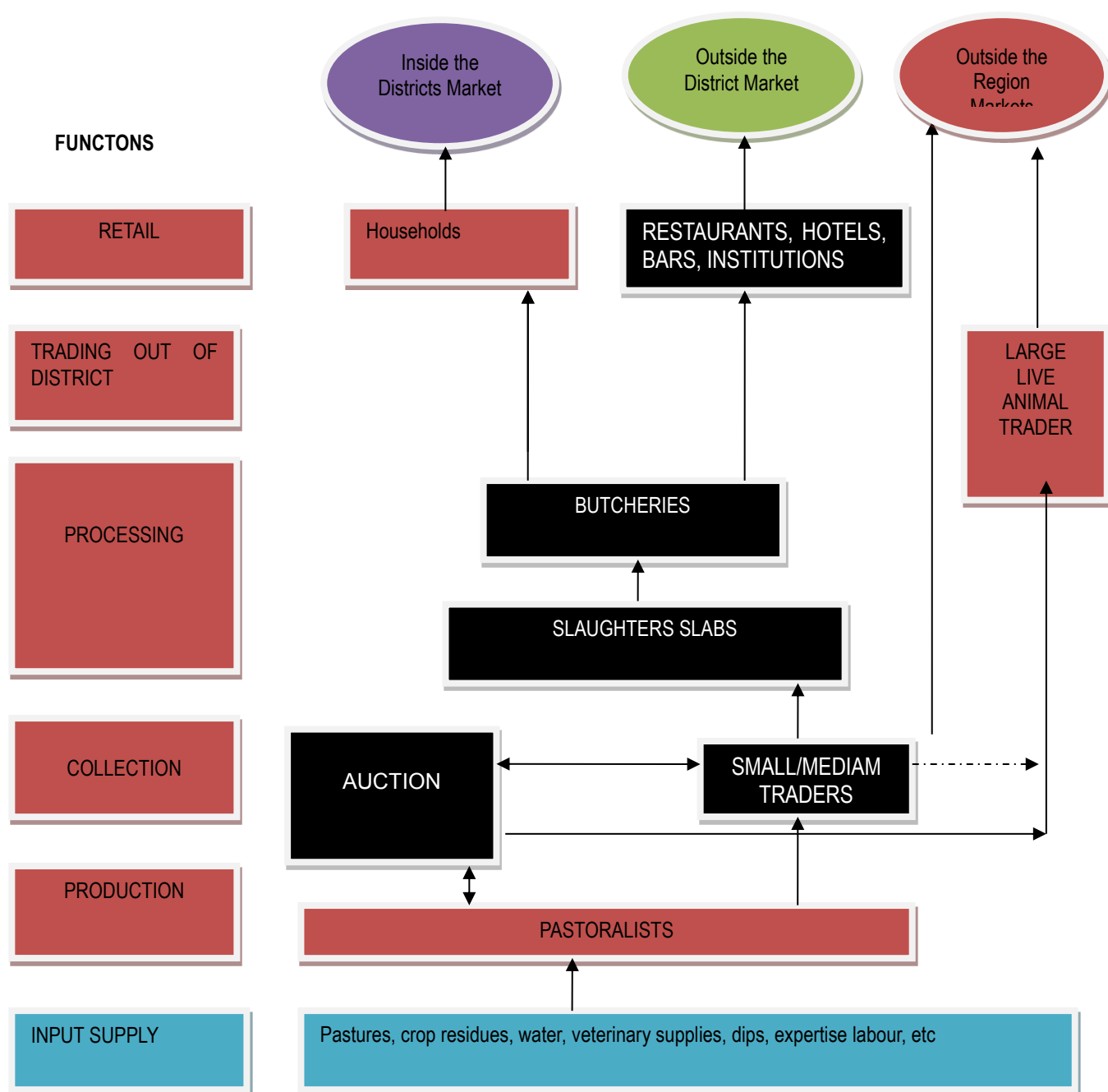
Large cattle traders purchase animals mainly at auctions. However small/medium traders also provide an important link between auctions and large traders. It was revealed that small/medium traders may occasionally purchase cattle from auctions and sell them to large traders.

Another segment of cattle buyers are the pastoralists themselves, who often purchase cattle for restocking purposes, for draft power and dowry. To maintain their herd size, pastoralists often sell large cattle, such as a large un-castrated bull, and purchase smaller ones such as young bulls or heifers.

According to district livestock officers, large traders form the main segment of cattle traders in the valley. Relatively, large numbers of cattle are traded outside the valley and mostly to outside the region. Local sales are dominated by butchers who mainly purchase in bulk.

All cattle purchased by butchers are slaughtered on slaughter slabs; most of which are privately owned and a few are government property. Regardless of ownership, all slaughter slabs are managed under the same regulations.

Butchers shops were the main meat outlets. Most of the butcheries are located in the town centres of Ifakara, Ulanga, Malinyi and Mlimba, where meat consumers are relatively abundant. About 40 butcheries were reported in Ifakara town, and nine, five and seven in Mlimba, Malinyi and Ulanga towns respectively.

Figure 1: Structure of the cattle and meat market in Kilombero Valley.

While cattle buyers are not required to register, they must pay a market levy to local government authorities ranging from 1,500 TZS per head (Mlimba), to 5,000 TZS (Ulanga and Ifakara), to 6,000 (Malinyi). Permits are generally not required for internal movements within district movements, but for out of district movements one must pay a fee of 2,500 TZS per head to district authorities. When purchasing from homes, for security purposes, it is necessary to get a notification from local hamlet/village officials, and this costs 500 TZS per head.

Prices of cattle vary according to weight, which is influenced by sex and size, as well as by season and location. Prices are lower during the wet season due to high supply and low demand, rising during the dry season in response to increasing demand and reducing supply. During the wet season agro-pastoralists sell more animals in order to raise money for crop production, leading to strong supply. During the dry season there is the option of selling crops to raise money for household needs so supply is weaker. During the wet season demand for meat reduces due to greater availability of fish and green vegetables, as well as reduced spending power by consumers, and the reverse applies for the dry season. Market prices are further depressed in some places due to the poor condition of roads and the inaccessibility of markets; this precludes participation of many potential buyers thus leading to reduced competition.

Traders generally only buy medium or large animals. Prices were reported to vary as follows:
Medium cows: from 250,000-475,000 TZS (wet season) to 575,000-650,000 TZS (dry season)
Large cows: from 400,000-650,000 TZS (wet season) to 700,000-900,000 TZS (dry season)
Medium bulls: from 250,000-600,000 TZS (wet season) to 400,000-750,000 TZS (dry season)
Large bulls: from 450,000-800,000 TZS (wet season) to 700,000-1,200,000 TZS (dry season)

From the auctions hired labour is used to move purchased cattle on foot to the main urban centres. For security purposes it is usually necessary to have two or more people. Labour costs vary depending on the distance and number of animals to be moved, ranging from about 10,000-80,000 TZS for two people.

All slaughtering takes place at designated slaughter slabs. Cattle are purchased and transported in bulk, such that there is often some delay between arrival at the slaughter slab and actual slaughter. During this time the traders pay fees for herding and security. These ranged from 1,000 TZS per person per day at Ifakara, to 5,000 TZS per person per day at Ulanga, to 60,000 TZS per person per month for Mlimba.

At the slaughter centre animals should be inspected by a livestock officer before and after slaughtering. Slaughtering is done by a Muslim man, appointed by BAKWATA, and using a knife. Slaughter fees varied from 500 TZS per head for Ifakara to 2,000 TZS for Mlimba and Ulanga and one kg of meat at Malinyi. In addition, it is necessary to pay a fee to the slab owner ranging from 2,000 TZS per head for Ifakara and Mlimba to 2,500 TZS for Malinyi to 5,000 TZS for Ulanga. Butchers are responsible for skinning, for which they usually use hired labour, the costs of which range from 10,000-20,000 TZS per head.

Blood, dung, and cattle horns are the main waste products from the slaughter slab. Cattle horns are placed in a specific dumping place. Though their market were not clear, cattle horns were reported to have value and there are people who collect them from the dumping site free of charge. Blood was reported to be collected for trading as a chicken feed.

At the slaughter slabs, heads, leg joints, stomachs and some internal organs may be sold directly to food vendors. The remainder of the meat is transported to butcheries, these being the formal outlets for meat. Transport from the slaughter slab to butcheries is done by bicycle or motorbike and ranges in cost from about 3,000 TZS (Malinyi) to 7,000 TZS (Ifakara) to 15,000 TZS for Mlimba and Ulanga.

Butcheries are required to adhere to certain hygiene and design standards enforced respectively by health officers and livestock officers. Whilst most butchers conform to hygiene requirements, in many cases the buildings do not yet meet required standards. Offenders are typically warned and fined and in severe cases may have their operations suspended. Butchers are also expected to have a business license and, in the centres of Ifakara and Mahenge, also a TFDA license.

The main buyers of meat include individual consumers, government workers, institutions like schools, and restaurants and bars. While sales to government workers and institutions are relatively stable through the year, purchases by individual consumers are higher during the dry season. Restaurants and bars purchase meat for processing and trading; their business shows a similar seasonal pattern being higher in the dry season and reduced during the wet season. Actual volumes of sales during the wet season were reported to range from 15-19 kg/day per butchery for Mlimba, to 33 kg/day for Malinyi, to 50 kg/day for Ulanga and 75-100 kg/day for Ifakara. Corresponding figures for the dry season were 25-40 kg/day for Mlimba, 50 kg/day for Malinyi, 100 kg per day for Ulanga, and 120-180 kg/day for Ifakara.

Prices also vary seasonally for Mlimba and Malinyi, from 5,000-6,000 TZS/kg during the wet season to 7,000 TZS/kg during the dry season. For Ulanga and Ifakara the price was said to be maintained at a constant value of 7,000 TZS/kg throughout the year.

While district offices appear to have reasonable records of numbers of animals moved outside the districts, as movement permits are required for all such movements, their records for within district movements cannot be considered reliable, since many movements take place without permits and so are not recorded.

Annual movements from Ifakara District to outside of the region were 50,376 for 2012, 22,048 for 2013 and then falling to below 1,000 for the next three year (542 for 2014, 731 for 2015 and 361 for the first six months of 2016). The high figures for 2012 (especially the third and fourth quarters) and for 2013 (particularly the first quarter) appear to be a direct result of the government forced destocking programme implemented at that time. Since that time the limited data obtained on numbers of animals slaughtered suggests that within valley sales are probably higher than exports to other regions. For example, at the Mahenge town slaughter slab, a total of 6,401 cattle were slaughtered over the six year period 2011-2016 (to third quarter of 2016); this equates to an annual mean of 1,068 cattle (as compared to the above recorded annual movement of 731 animals from Ifakara District in 2015).

Trading of meat takes place in restaurants and bars. Key informants provided estimates of the number of outlets in the main centres, which ranged from 30-40 for Mlimba, 40 for Malinyi, 20 for Ulanga and 20-100 for Ifakara. These figures are unlikely to be reliable. Daily throughput ranged from 3 to 10 kg per day during the wet season, rising up to 30 kg/day in the dry season. Restaurant owners often buy a daily mix of steak (no bones, 8,500 TZS/kg), mixed meat (7,000 TZS/kg) and organs (5,000 TZS/kg). These are used to make soup or else served as meals with fried or roasted meat. One plate of soup sells at about 2,000 TZS, and one kg of meat can provide between 6 to 14 soup meals, thus providing income of about 20,000 TZS. Roasted or fried meat sells at about 4,000 TZS per plate and one kg can provide about three meals or income of about TZS 12,000.

Restaurants and bars are expected to have a business license (100,000 TZS per year issued by district authorities) and a TFDA license (30,000 TZS), and to comply with TRA procedures. Including tax, these can amount to a total of about 800,000 TZS per year. Other expenses include waiters, rent and utilities. Moreover, all waiters are expected to undergo a medical check at least once a year, which costs about TZS 8,000 per person. Unfortunately, data on numbers of employees were not collected.

3.5 Challenges, conflicts, environmental impacts and trends

3.5.1 Challenges faced by livestock keepers

Inadequate grazing areas was identified by PRA participants as the primary challenge facing livestock keepers in the Kilombero Valley, being noted for all 15 villages and accounting for 61.2% of overall relative importance. The second most important challenge was difficulties in accessing water sources for livestock (16.4% and n=13 villages). This was due to restrictions on livestock using some water points, or due to narrow stock routes to the water points, or encroachment of water streams by farming activities. Difficulties in accessing water sources were mainly noted to be a challenge during the dry season when temporary rain water sources have dried up.

Heavy fines, as mentioned in six villages, were the third most important challenge (8.8% of overall importance). The main causes of fines were due to livestock grazing in fields, grazing in village protected areas such as the ILUMA WMA, grazing in the KGCA, grazing in the Selous Game Reserve, and watering at restricted water points within the village.

Other challenges included difficulties in access to veterinary supplies (6.5%), inadequate or sometimes absence of extension services (2.0%), low livestock market prices (1.9%) and livestock diseases (1.0%). Despite the fact that all villages noted the absence of a dipping facility (plunge dip), in terms of importance this challenge was scored at only 0.8%, probably due to the fact that many pastoralists have extensive experience in self administering sprays and other disease control measures.

The majority of HHQ respondents (85.3%) recognised the existence of one or more challenges to livestock production. Overall, the number of factors identified for the wet season (n=801) and dry season (n=772) were similar and, other than access to water resources which were more constrained during the dry (13.6%) as compared to the wet season (2.7%), for most other factors the variations between seasons were relatively minor. Challenges in terms of inadequate grazing resources (23.5% vs. 21.8%) and the imposition of fines (18.0% vs. 15.0%) were slightly higher in the wet season as compared to the dry.

Other common challenges were poor veterinary services (16.3% of total 1,573 factors), inadequate extension services (13.1%), inadequate markets (11.1%), inadequate water points (8.1%), lack of knowledge on livestock management (7.2%), inaccessibility of good cattle breeds (3.2%), and other factors (diseases, floods, narrow routes, predation, costs of branding, government officials, unfavourable policies and unfair treatment of pastoralists, collectively = 2.4%).

A strong majority of HHQ respondents (85.0%) reported the existence of rules or restrictions on livestock keeping activities. The most frequently mentioned restrictions concerned grazing within the KGCA (36.0% of respondents), grazing in neighbouring villages (33.7%), grazing in village protected areas (28.3%), restricted access to certain water sources (22.0%), and others (17.7%). Within the other categories, the most frequent factors were restrictions on grazing in farms and fields (6.7%) and within the KVTC concession area (2.3%), restrictions on the number of animals permitted per household (2.0%), grazing within the Selous Game Reserve (1.3%), restrictions from using village roads (1.3%), and grazing along the railway line (1.0%).

Combining all factors, the most relevant authorities in terms of enforcing restrictions on livestock activities were village governments (52.7% of responses), followed by KGCA/RAMSAR authorities (16.7%), plus TANAPA/wildlife authorities (8.3%) and government (6.7%). Ward councils and district authorities were mentioned but not seen as being important in this respect.

The key impact of restrictions on access to grazing was inadequate grazing resources (36.3% of HHQ respondents) and inadequate access to water (41.8%). This leads to a range of secondary impacts including heavy fines (16.7%), poor health and condition of livestock, lower rates of reproduction (15.2%) and even death of animals (3.0%). Poor animal health leads to lower productivity (4.2%), lower prices and income and thus increased poverty (3.5%). Limited access to grazing also leads to increased conflicts (6.1%), cattle being confiscated or killed (4.2%), and poor treatment of pastoralists (1.3%), collectively leading to an eventual decline in pastoralism (1.5%). Only 3.4% of respondents reported no impacts, in general these being respondents with low numbers of animals.

3.5.2 Conflicts

The most common form of conflict over natural resources, and reported in all the PRA study villages, was between farmers and pastoralists. The second most frequent form of conflict was over village boundaries (n=10 villages), followed by conflicts between farmers (n=4), land conflicts and farm boundaries (n=3 each), conflict with the KVRS, and conflicts between villagers and government (n=2 each). Another 12 forms of conflict were reported in only a single village each.

More specifically, pastoralists identified eight different forms of conflict: with farmers (n=15 villages), the KGCA (n=7), village governments (n=6), among pastoralists themselves (n=3), with investors, district governments and fishermen (n=2 each), and with WMAs in one village (Kivukoni with the ILUMA WMA). The most important of these were conflicts between pastoralists and farmers, which accounted for 47.6% of the overall relative importance, followed by conflicts with the KGCA (31.7%). Most conflicts were attributed to the breaking of rules and regulations.

The main cause of conflict between pastoralists and farmers was due to cattle trespassing into farm lands and destroying crops.

Concerning the KGCA, the cause of conflict with pastoralists was seen as being the imposition of unrealistic rules and regulations, which enforce restrictions on access to pastures and water within the KGCA but without providing any alternatives. Conflicts thus arise when cattle are found grazing or taking water inside the KGCA. Pastoralists were noted to graze inside the KGCA as a result of scarce grazing pastures inside their respective villages. In some villages like Namawala and Mofu, the conflict was reported to be fuelled by expansion of the KGCA boundary into village land, whereby a significant portion of land that was previously used for grazing was annexed to the KVRS.

Conflicts between pastoralists and village governments were reported to be caused by the ineffectiveness of village leaders to manage land in their respective villages. For example, in allowing the KGCA to annex part of the village land without the consent of the village assembly; allocating large areas of village land to outsiders for farming without following due procedures; not following the agreed land use plan; and allocating farms in the settled grazing areas (double allocation). Other causes of conflicts were related to restrictions on grazing along water channels within the village, and allowing other pastoralists from outside the village to come with their cattle and reside inside the village thereby increasing pressure on already scarce grazing resources.

Conflicts between pastoralists and investors were reported in Ngalimila village (3.2% of HHQ respondents) and Namuhanga village (3.4%). Participants from Ngalimila village claimed that RUBADA took about 5,000 hectares from the village land for cultivation, with the promise that they would build social services in the village; but to date no social services had been provided and yet the land cannot be returned. For Namuhanga, participants reported conflicts resulting from livestock entering to graze inside the KVTC areas (in the areas which they do not cultivate) during the period March – June. During this time pastoralists from Namuhanga village often have no other feasible

grazing options as everywhere else is flooded and therefore pastoralists are forced to enter the adjacent upland areas of the KVTC.

Conflicts between pastoralists and district governments and between pastoralists and fisheries were reported in two villages each. The former were noted to be caused by restricting pastoralists to a limited number of cattle per household. Another reported cause was inconsistency and irregularities of livestock programs which confuses the pastoralists. For example in 2012, the district government came up with a programme of identifying and registering all livestock, whereby cattle from every village were marked. However, during the same year, the same government embarked on an eviction operation of pastoralists to unknown areas, including of animals that had recently been marked. On the other hand the conflict between pastoralists and fisheries were reported to be caused by destruction of fish traps by livestock when they take water in rivers. The use of illegal fishing methods, especially the use of poisons which pollutes water for livestock consumption, was identified as another source of conflict between pastoralists and fishermen.

Similar results concerning conflicts were obtained from HHQ respondents. Two thirds of respondents (67.3%) reported the existence of conflicts between pastoralists and other land users. The most frequent type of conflict was with farmers (50.7% of positive responses), followed by KGCA/ RAMSAR authorities (23.7%) and village governments (17.7%). Additional low frequencies of conflicts were reported with other pastoralists (6.0%), investors (3.7%), fishermen (0.7%) and others (1.7%). Named investors included KVTC, KNSTC, Bushmen Company, Makangoro Nyerere, Miyambe North Safari, Mohamed Sugar Company, Usanga and Wildlife investors. Others included District governments, Selous Game Reserve, schools and prison authorities (Kiberege).

Conflicts with farmers were reported to be more frequent during the wet season (n=180) than the dry season (n=90), and with only 5.3% of respondents reporting no conflict during the wet season as opposed to 41.6% during the dry season. For both seasons, the most frequent form of conflict was cattle destroying crops in fields (wet season = 50.0% and dry season = 47.8%). The issue of heavy fines was the second most frequently mentioned form of conflict in both seasons (16.1% wet season and 14.4% dry season). Thereafter, the next most frequent forms of conflict during the wet season were the expansion of fields into grazing areas (10.0%), narrow routes/blocking of access routes to water sources (8.8%) and conflicts over land and grazing areas (5.6%), and boundaries (3.3%), and the unfair treatment of pastoralists (3.8%). Other conflicts during the dry season were blocking access routes to water (12.2%), conflicts over grazing areas (10.0%) and boundaries (3.3%), expansion of crops into grazing areas (5.6%), unfair treatment of pastoralists (4.4%) and the destruction of bricks near water sources (2.2%).

Conflicts with KGCA authorities were more frequent during the dry season (n=80) as compared to the wet season (n=64), the principal difference being access to water sources which was more significant during the dry season (27.5% of responses) than the wet season (3.1%). For both seasons, the principal issue was restrictions on grazing resources (wet season 65.6% and dry season 46.3%). The other main form of conflict was heavy fines (20.3% wet season and 18.8% dry season).

A wide range of issues were raised around conflicts with village governments. The seasonal pattern was for slightly higher levels of conflict in the wet season (n=56) as compared to the dry season (n=48), and with seven respondents reporting no conflict during the wet season versus 11 during the dry season. The main issues were centred around grazing resources, in the form of restrictions on where animals can graze, cattle intruding into fields and farms, pastoralists entering into village protected areas (e.g. designated forests and rivers), a lack of settled grazing areas, the conversion of grazing lands to farms, expansion of farms to block movement routes (collectively, 39.3% wet season and 35.4% dry season). A key impact of these conflicts was the imposition of heavy fines (26.8% wet season and 18.8% dry season).

There was also a frequent perception that village governments did not understand pastoralists well and treated them unfairly, stated as: misunderstandings, restrictions on cattle numbers, confiscation of cattle, siding with farmers and imposing unjust demands for compensation for destruction of crops, charging high fees to register cattle, forcing livestock keepers to mark cattle, yet failing to develop any livestock infrastructure, nor providing any assistance in times of need, collectively totalling to 28.6% in the wet season and 27.1% for the dry season).

In terms of conflicts between pastoralists themselves, there was little variation from the wet season (n=18 responses) to the dry season (n=16). The most frequently mentioned form of conflict was over limited or scarce grazing resources (77.8% for the wet season and 43.8% for the dry season) and, in the dry season, also water points (again 43.8%). Other minor issues (n=1 each) included animals being killed, death of pastoralists, boundaries not being clear and conflict with farmers.

Conflicts with investors were mentioned by 10 respondents during the wet season and seven during the dry season. The main issues were loss of land, restrictions on grazing and the imposition of heavy fines and, in the dry season, one respondent noted loss of access to water.

3.5.3 Environmental impacts

PRA participants considered environmental degradation in general within their respective villages, whilst HHQ respondents were specifically questioned whether livestock cause any detrimental impacts to the environment.

Deforestation and uncontrolled fires were the most frequently identified environmental issues by PRA participants, being identified across all eight villages where impacts were assessed. Other issues were illegal fishing (n=7), poaching, uncontrolled livestock keeping and unplanned farming (n =4 each), and destruction of rivers and dams (n=2). Other issues were identified in only one village each.

Poverty was noted to be the common driver for many forms of degradation including charcoal burning, cutting trees, poaching and illegal fishing. Poor law enforcement, lack of education and awareness, large populations of livestock, lack of employment opportunities and alternative income generating activities, absence of alternatives source of cooking energy, and inadequate grazing lands are some of the other factors that contribute to environmental degradation in the Kilombero Valley. Impacts of degradation include the loss of biodiversity (forest, wildlife, fish, and natural vegetation), as well as droughts, conflicts between communities and climate variability/change.

As potential solutions participants suggested increased participation of local communities in the management of natural resources, strengthening of law enforcements efforts, provision of education and awareness on importance of the environment and conservation, provision of alternative income generating activities and provision of capital, loans and credits to youths. Other proposed solutions were to provide alternative sources of energy for cooking and the establishment of tree planting programs.

3.5.4 Environmental impacts caused by livestock

The majority of HHQ respondents recognised that livestock do cause detrimental impacts to the environment (59.7%), with 4.3% being uncertain and 36.0% not admitting to any damage. A total of 332 impacts were recorded. Two main areas of impact were perceived. The one related to the destruction of wetlands and water resources (15.4%) leading to a general drying of the environment and acceleration of drought (18.1%). Related to this was the clearing of trees and the loss of natural

vegetation (3.9%) leading to the elimination of wildlife (1.0%) and environmental degradation in general (2.7%).

The second broad group of impacts was related to soils, principally in the form of compaction of soils due to trampling (22.2%), and increased soil erosion (17.5%), but also river bank erosion (6.0%), loss of soil fertility (1.8%), the trampling of fields in the wet season making them sticky and hard to cultivate (0.6%), and the formation of tracks and damage to roads (each 0.3%).

A third, less frequently mentioned area of impacts concerned water resources, specifically the pollution of water (6.0%) and interference with fish and fish breeding sites (3.3%).

3.5.5 Natural resource trends

PRA participants were asked to score trends of how levels of identified natural resources have varied over time from 2000 to 2016, what are their expectations for the future through to (2030), and to provide explanations for perceived or expected changes.

For most villages most natural resources were perceived to have declined from the past to the present and were expected to continue to do so into the future. This includes access to land, size of farms, crops, forest resources, wildlife, rivers and fish.

Population growth was seen as being a key driver of declining access to land and decreasing sizes of farms, coupled with poor land use planning and law enforcement and losses of land to investors. Factors perceived to be driving declines in crop production were climate change, decreasing soil fertility, trampling of soil by livestock, and a lack of land and agricultural inputs. For forest resources, the main drivers of decline were identified as population growth, illegal harvesting of forest products, the use of wood fuel, expansion of fields and poor law enforcement. Factors behind wildlife declines were increases in livestock and farming activities leading to loss of habitat, coupled with illegal use and poor law enforcement. Supporting explanations for the changing status of rivers were due to climate change, environmental degradation and poor enforcement of regulations, coupled with declines in hippo (that used to keep river channels open) and increases in livestock. Declines in fish populations were attributed to illegal fishing, destruction of water sources, increase in fisheries and poor law enforcement.

Results for livestock were mixed. With the exceptions of Namawala and Lukande villages, where livestock were perceived to be decreasing, for the other five villages where they were scored livestock were reported to be increasing. The reasons given for decreasing trends were due to increase in human populations and settlement and the expansion of farming activities and concurrent decrease in pastures. The reasons for predicted increases in livestock were continued immigration of pastoralists and livestock, poor law enforcements and increase in use of draft animals for cultivation by non-pastoralists.

3.5.6 Trends in pastoralism indicators

Whilst the number of pastoralists was generally perceived to have increased to present (n=13 villages), predictions for the future were mixed, with nine village predicting continued increases and six villages decreases. The main reason provided for decreasing numbers were that grazing areas will continue to decline; expected increases in numbers were mainly attributed to more people starting to keep cattle for cultivation purposes.

Fields were consistently perceived to have expanded greatly from the past up to the present (n=14 villages). However, opportunities for continued future expansion were perceived as being limited

due to a lack of land (no more land for crop expansion, no land bank for crop expansion, n=13 villages). Five villages predicted a future decrease in farm sizes due to the need to accommodate the growing population on the same amount of land. Participants from two villages pointed out that the trend of farmland expansion may continue due to expansion into grazing areas and village open areas.

Grazing areas were consistently predicted to decrease for all villages, and the same was noted for water sources (n=13 villages). Declines in grazing areas were attributed to population growth and accompanying growth of farming which reduces grazing lands, continued expansion of protected areas such as the KGCA, and poor planning and management of land. The postulated reasons for decreasing access to water were climate change effects, siltation effect to water sources as results of un-controlled farming along the rivers, blockage of access to water sources for livestock due to farming activities, restrictions posed to some of the water sources and continued degradation of catchment areas.

Overall cattle populations were generally expected to decrease (n=13 villages), in line with a decrease in grazing areas fuelled by population growth and continued expansion of cultivated areas. Other reasons included restrictions on livestock numbers, impacts of heavy fines and changing lifestyles whereby in future children may prefer to follow other activities than livestock keeping. For the two villages where increases were predicted, this was attributed to an increasing demand for cattle for cultivation purposes.

Losses of cattle due to deaths was reported to have decreased over time in all villages from the past (2000) to the present (2016) and, other than for Kivukoni, Biro and Lukande villages, this trend was expected to continue into the future (2030). The main reason for the decreasing trend was due an increased availability of veterinary supplies, and to a limited extent due to a decline in diseases (e.g. for Ngoheranga it was noted that the prevalence of tsetse fly had decreased greatly). The principal reason put forward for increasing numbers of deaths was the expected decrease in grazing areas.

The trend of selling cattle was expected to increase in future in most villages (n=13). The most commonly mentioned reason was an increase in livelihoods needs (such as schooling, buying food, paying fines etc) which will require the selling of more cattle. Additionally, the demand for livestock products is expected to increase due to population growth leading to increased demand for meat, coupled with an expected decline in potential substitutes in the form of game and fish, and also inadequate grazing pastures will force pastoralists to reduce their cattle herds.

The trend of buying cattle was perceived to have increased from the past to present (n=12 villages), but in future is expected to decline again (n= 13). The reason for the previous increase was that other non-pastoralists tribes have increasingly been encouraged to buy cattle for cultivation purposes; the reason for the decreasing trend in future was attributed to an anticipated shortage of grazing pastures which is likely to discourage pastoralists from buying additional cattle.

In terms of conflicts, those with wildlife were expected to decrease; with other pastoralists and fishermen to remain constant; and with farmers to increase. Decreasing conflicts with wildlife were attributed to a massive decline in wildlife populations (in the past there was a lot of wildlife, but now wildlife are very rare or completely absent). On the other hand, conflicts between pastoralists and wildlife management authorities were expected to remain the same (n=6 villages, principally those villages that do not border against any conservation areas), or increase (n=9 villages). Reasons for increasing were due to a continued need to graze in protected areas (such as the KGCA, Udzingwa National Park and village protected areas), driven by a scarcity of pastures in village areas, combined with an increased enforcement effort by wildlife officers.

The predicted trend of increasing conflicts between pastoralists and farmers (n=13 villages) was attributed to continued population growth and resulting expansion of farming activities leading to a reduction of grazing areas.

Finally, PRA participants were asked to evaluate the trend of the general status of the livestock sector in the village. The bulk of villages perceived a decrease from the past to the present (n=12 villages) and anticipated a continued decline into the future (n=13). The trend was reported to be attributed to a number of challenges, principally decreasing grazing areas/pastures due to an increase in population and associated demand for land for settlements and farming activities, but also due to increased restrictions on livestock numbers, as well as a shift towards cultivation by pastoralists themselves.

HHQ respondents were divided as to the future trajectory of livestock keeping, with equal numbers of respondents predicting that livestock keeping will improve in the future (45.7%) or decline (47.3%), with a minority expecting no change (7.0%). The relative proportions of positive and negative responses varied markedly between tribes. Members of other tribes were most optimistic, with 67.1% of respondents being hopeful of improvement, as compared to 41.3% for Sukumas, 33.3% for Barbaigs and only 26.5% for Maasai. Perceptions of a decline exhibited the opposite pattern: being highest of the Maasai 67.6%, followed by the Barbaig 66.7%, Sukumas 50.6% and other tribes (26.3%).

By far the most frequent argument for improved conditions was the expectation that respondents/ existing livestock keepers would continue to increase their numbers of livestock (56.2% of 185 responses). There was also an expectation that the number of livestock keepers would grow (4.9%), due in part to the growing realization that livestock can improve livelihoods (9.7%), increased awareness of the benefits of using livestock for ploughing (8.1%), and continued in-migration of pastoralists (3.2%). Other respondents noted that the Kilombero Valley provides a favourable environment for livestock (8.1%), the availability of sufficient pastures (1.6%), and high survival rates of livestock (1.1%). Yet others postulated a reduction in conflicts (2.2%) and improvements in management (3.8%).

The principal argument put forward for no change was the imposition of restrictions on the numbers of cattle per household (50.0%), coupled with inadequate pastures (20.8%).

A wide range of negative drivers were identified (229 responses). These were classified into four groups. The most numerous were factors relating to congestion and inadequate grazing resources (36.7%), including too many livestock keepers and cattle, expansion of farms into grazing areas, lack of secured grazing areas, and loss of grazing areas to external investors. Second in terms of frequency were government restrictions and unfavourable policies (29.7%), including forced reductions and removals. The third group related to conflicts, principally with farmers (20.1%), including the imposition of heavy fines, the confiscation of cattle and injury to cattle. Least frequent were factors relating to other production factors (13.5%), including inadequate water resources, diseases and poor veterinary services and the absence of infrastructure.

4 DISCUSSION

4.1 KEY FINDINGS

Key findings are presented in relation to the main lines of enquiry as requested under the study framework (Table 3).

Table 3. Key findings of the study.

Issues	Main Findings
a. The pastoralist background in the KVRS	
Pastoralist's household livelihoods and patterns of land access and use within KQRS	<p>Livestock keepers in the Kilombero Valley comprise a mix of immigrant Sukuma, Maasai and Barbaig "large pastoralists", and other "small" livestock keepers belonging to a number of other tribes such as Ndamba, Bena, Ngoni and Pogoro, many of whom are considered as indigenous to the valley.</p> <p>The community of livestock keepers is dominated by Sukumas, then small pastoralists, then Barbaig and Maasai; numbers of cattle appear to follow the same pattern of ownership.</p> <p>The distinction between large and small livestock keepers is not clear cut, with some large pastoralists having few cattle (<10) and some small keepers having large numbers of animals (up to 100).</p> <p>Virtually all livestock keepers also carry out some farming. One quarter of HHQ respondents recognized crop farming as their most important livelihood activity, another 39.0% considered themselves as mixed producers (crop and livestock producers).</p> <p>The proportion of HHQ respondents who identified themselves as being primarily livestock keepers was highest among Barbaig and Maasai, intermediate for Sukumas and lowest for other tribes and, conversely, the proportions of crop farmers were lowest for Maasai and Barbaig, intermediate for Sukumas and highest for other tribes.</p>
Formal and informal land access systems	<p>Most, but not all, pastoralists have followed formal channels and are registered in the village where they live.</p> <p>Some pastoralist families have come to join their families and have not registered within villages.</p> <p>Most pastoralist households own land in the village where they reside, with an overall mean estimated value of 36.7 acres per household.</p> <p>Land is typically used for crop and livestock production, or else just crop production.</p> <p>Sukumas tend to own private land for farming and livestock keeping whilst Maasai and Barbaig often do not own private land, such that they are reliant on access to communal land for grazing of livestock.</p>
Current integration with farming	<p>Integration with farming is significant and growing.</p> <p>Large pastoralists are increasingly turning to crop production, particularly for Sukumas and less so for Barbaig and Maasai, whilst there is growing adoption of livestock production among other resident tribes, largely driven by increasing recognition of the value of draft animals for ploughing (as well as for transport and manure).</p> <p>Among livestock producers, 58.1% of total income was reported to be derived from livestock and 39.0% from crop production. Maasai and</p>

Issues	Main Findings
	<p>Barbaigs derive the bulk of their income from livestock, with some supplementary income from crops and running small businesses; members of other tribes derive their principal income from crops supplemented by earnings from livestock and businesses; and Sukumas occupy an intermediate position earning their major income from livestock, but with additional significant income from crops, plus some from businesses.</p> <p>Virtually equal expenditure was reported on livestock and crop production. Barbaigs, Maasai and Sukumas invest more in livestock than "Other tribes", whilst the pattern is reversed for crops.</p>
<p>Opinions held by pastoralists and other stakeholders on resource conflicts: causes and solutions</p>	<p>Pastoralists face a number of restrictions that have been imposed on their livestock keeping activities, including grazing in village protected areas, grazing in neighbouring villages and grazing inside the KGCA, as well as concerning the use of certain water sources. The bulk of conflicts arise through violating such restrictions.</p> <p>Key institutions responsible for enforcing rules and regulations include village governments, KGCA/RAMSAR authorities and TANAPA/wildlife authorities; ward councils and district authorities were seen as being less relevant in this respect.</p> <p>The main form of conflict is between livestock producers and farmers due to cattle entering fields and damaging crops. This is most frequent during the rainy season.</p> <p>Other important forms of conflict are with the KGCA/RAMSAR authorities and with village governments.</p> <p>Conflict with KGCA/RAMSAR is caused by pastoralists grazing and watering cattle within the KGCA area, most frequently during the dry season.</p> <p>Conflicts with village governments centre around access to grazing resources and include restrictions on where livestock can graze, cattle intruding into farms, and village protected areas, the absence of designated grazing areas, the conversion of grazing areas into fields, and the expansion of farms such that livestock movement routes are constricted or blocked.</p> <p>Livestock producers have a perception that village governments do not understand and support livestock production; that in cases of disputes they tend to side with farmers and impose unfair penalties on livestock producers, including the confiscation of cattle; that they impose unreasonably high fees and restrictions in terms of cattle numbers and the marking of cattle (note that such regulations concerning cattle numbers and the marking of cattle are mandated by district governments rather than at the village level); while neglecting to invest in livestock infrastructure.</p> <p>Conflicts with other groups do occur but were considered to be of relatively minor importance, including among pastoralists themselves and with large investors, as well as with fishermen and wildlife.</p> <p>Impacts of restrictions and conflicts include restricted access to grazing resources and inadequate access to water. These lead to a range of secondary impacts including heavy fines, poor livestock health and condition, lower rates of reproduction and even death of animals. Poor animal health leads to lower productivity, lower prices and income and</p>

Issues	Main Findings
	thus increased poverty. Limited access to grazing also leads to increased conflicts, with cattle being confiscated or killed, and harsh treatment of pastoralists, leading to an eventual decline in pastoralism.
b. The livestock resource	
Size, composition and condition of herds, seasonal distribution and movement of livestock	<p>Cattle are the most commonly kept type of larger livestock, and by far the most important, followed by sheep and goats and chickens. Cattle account for 95.6% of the overall estimated value of livestock.</p> <p>Herd sizes, among HHQ respondents, varied from 2-700, with an overall mean of 50.5 cattle per household. Differences between tribal groups were marked, with mean herd sizes varying from 14.6 for members of other tribes, to 57.5 for Maasai to 60.2 for Sukumas to 98.4 for Barbaig.</p> <p>Cattle comprise various types of Tanzania Shorthorn Zebus, of which the most numerous among HHQ respondents were Tarime/Mara (59.5% of overall herd), followed by natural/Maasai (20.4%) and Ankole (12.7%).</p> <p>Most owners keep their cattle in a single herd. About one sixth of HHQ respondents reported keeping some animals belonging to others, and that some of their own animals were in the herds of others, in both cases usually elsewhere in the Kilombero Valley.</p> <p>For the 300 HHQ respondents, the overall herd comprised 5,868 cows, 3,198 calves, 2,604 heifers, 2,387 steers and 1,005 bulls.</p> <p>Cattle populations are currently growing fast. HHQ respondents, for the last 12 months, reported growth of 4,257 animals mainly through natural reproduction and purchases, versus losses of 2,069 animals principally through sales and deaths.</p> <p>Most households graze their animals in the same place each year. Cattle are principally grazed within village areas during both wet and dry seasons, mainly within reserved portions of farmlands during the wet season, and on crop residues in fields during the dry season. Use is also made of grazing resources in neighbouring villages and within the KGCA, particularly during the dry season. Only three villages had designated grazing areas and these were reported to be too small.</p>
Habitat requirements, migratory routes, interaction with wildlife	<p>The most important requirements for cattle production are grazing areas and water sources; other supporting needs are for veterinary supplies, extension services, plunge dips and markets.</p> <p>Although the Kilombero Valley offers excellent conditions for livestock production, access to pastures and water sources were identified as the two main challenges faced by pastoralists.</p> <p>Three quarters of HHQ respondents considered grazing resources to be inadequate, varying in general accordance with herd sizes from 60.5% for "Other tribes" to 75.6% for Sukumas to 83.3% for Barbaig and 88.2% for Maasai.</p> <p>Principle constraints include the absence of designated grazing areas, grazing areas often being constrained by farming activities, and continued encroachment by farms into grazing areas.</p> <p>During the rainy season pastoralist principally water their livestock in scattered rain water ponds within the village areas. During the dry season, nearly all rain water ponds dry up and most pastoralists make use of the Kilombero River and/or its tributaries, natural water dams, and constructed water ponds. Some of these are located inside the villages</p>

Issues	Main Findings
	<p>and some within the KGCA.</p> <p>The majority of HHQ respondents (77.7%) considered existing water sources to be generally adequate, with only 22.4% expressing reservations.</p> <p>The main problems regarding access to water resources were inadequate water points, restrictions on access to certain water points, water sources are surrounded by farming activities, and stock routes to water points are narrow.</p> <p>For HHQ respondents, the main sources of information about livestock management were from family members (46.0%), from other livestock producers (41.3%), from extension agents (32.3%), village leadership (14.7%) and cellphones (13.0%). Only 25.7% of respondents recalled being visited by an extension officer during the last 12 months, of whom one third reported a single visit and two thirds two visits.</p>
Use of grazing and water resources within the KGCA	<p>The two primary challenges faced by pastoralists are inadequate grazing areas and difficulties in accessing water sources.</p> <p>In response to inadequate grazing areas and water sources in village areas, and the absence of any alternatives, some pastoralists graze and water their animals within the KGCA, particularly during the dry season. This leads to conflict with the KGCA management authorities and the imposition of fines on offenders. Pastoralists identified such heavy fines as the third most important challenge that they face.</p> <p>Driven by decreasing grazing areas in village areas, as additional lands are continually allocated to new settlements and fields, combined with growing livestock populations, the level of use of resources within the KGCA and associated extent of conflicts can only be expected to increase.</p>
Interactions with wildlife	<p>Due to massively depleted wildlife populations, interactions with wildlife are now limited, and are expected to continue to decline in future.</p> <p>Occasional losses of livestock to crocodiles, lions and hyaenas were reported.</p>
Drivers and trends of natural resources and livestock	<p>Most natural resources were perceived to have declined from the past to the present and were expected to continue to do so into the future, including access to land, size of farms, crop yields, forest resources, wildlife, rivers and fish.</p> <p>Perceived drivers of change included population growth, expansion of fields, poor land use planning, losses of land to investors, illegal use of resources and poor law enforcement, decreasing soil fertility, and climate change.</p> <p>Future predictions for livestock were mixed with some participants predicting continued growth due to increased use of livestock for ploughing. However, the majority expected declining cattle populations due to human population growth and continued expansion of farms into grazing areas, coupled with restrictions on livestock numbers, impacts of heavy fines and changing lifestyles whereby in future children may prefer to follow other activities than livestock keeping.</p> <p>Livestock were recognized as causing a range of detrimental impacts to the environment, including physical degradation of wetlands and water sources, pollution of water sources, compaction of soils and increased</p>

Issues	Main Findings
	soil erosion, and losses of biodiversity.
Livestock health issues	<p>Diseases account for the bulk of cattle deaths, followed by accidents, predators and other causes.</p> <p>The most frequent diseases were Contagious Bovine Pleuro Pneumonia, lung disease/coughing, foot and mouth disease, lumpy skin disease, unknown disease, ndigana, trypanosomiasis, East Coast Fever, ndorobo, anaplasmosis and ndui.</p> <p>Virtually all HHQ respondents reported giving their cattle some form of health care over the last 12 months; this was overwhelmingly self-administered (94.0% of HHQ respondents). The principal forms of treatment were spraying, administering curative medicines, deworming and vaccinating. Only 2.7% of respondents reported dipping their animals.</p> <p>Annual cattle deaths were perceived to have declined since 2000 to present, mainly due to improved availability of veterinary products, and this trend was predicted to continue into the future.</p>
c. Economic Value of the Sector in the KVRs	
Identification and assessment of drivers for pastoralism at national scales	<p>Key drivers of pastoralism at the national level include:</p> <p>Population growth,</p> <p>Increased demand for land (including for family farming, conservation and for large farming and tourism businesses),</p> <p>National policies and legislation on livestock, governance, management of land and natural resources, and economic development</p> <p>Conflicts, including state sponsored displacements and evictions from former range areas</p> <p>Climate change, resulting in increased magnitude and frequency of extreme climatic events such as droughts and floods</p>
Assessment of the economic value of the sector within the KVRs	<p>A Total Economic Valuation (TEV) framework has increasingly been applied to assess the overall economic contribution of pastoralism; however even in a simplified form the TEV framework remains a vast territory of enquiry and was beyond the scope of the present study. Here, it was attempted to quantify marketed products and services, and to provide a preliminary analysis of the local red meat value chain.</p> <p>The most frequently reported cattle products and services were for ploughing fields (93.0% of HHQ respondents), milk (84.3%), sales of live animals (45.3%), meat (24.3%) and use for transport (19.7%).</p> <p>The most frequent forms of income were through ploughing (52.7%), followed by selling live animals (45.3%) and milk (37.0%), providing transport (7.3%) and the selling of meat (2.7%).</p> <p>In terms of income generation, live sales were the major earner (537.5 million TZS), followed by milk (474.1 million TZS), then ploughing (87.6 million TZS), meat (7.1 million TZS) and transport (3.7 million TZS).</p> <p>Scaling these figures up from the household survey (300 respondents) to the reported overall number of cattle keeping households in the three districts (13,842 households), the estimated total annual income from livestock for the three districts is 49.9 billion TZS. This figure excludes additional values of subsistence production, inputs to other sectors, meat chain linkages and complementary products derived from grazing</p>

Issues	Main Findings
	grounds.
Local meat chain	<p>Most cattle are sold at auctions. Purchasers include large buyers (who use trucks to move animals to distant markets outside the region), small buyers (who supply meat to urban centres within the Kilombero Valley), and pastoralists themselves who buy animals for restocking purposes. From the auctions, cattle are taken on foot to urban centres for slaughtering. All slaughtering takes place at designated slaughter slabs. After slaughter, heads, leg joints, stomachs and some internal organs may be sold directly to food vendors. Other meat is generally transported to butcheries, which provide the formal outlets of meat. The main buyers of meat include individual consumers, government workers, institutions like schools, and restaurants and bars, of which the latter purchase meat for onward processing and trading.</p> <p>The meat chain thus encompasses a wide variety of participants. In addition to pastoralists, it includes service providers (such as suppliers of veterinary products); livestock extension agents; hired labour (for herding, moving animals to markets and urban centres, and for skinning of animals); traders and brokers (large traders, small traders/butchers and pastoralists); slaughter slab owners; slaughterers; transport riders who move meat from slaughter slabs to butcheries (by bicycles or motorbikes); government inspectors (livestock officers and health officers, who inspect live animals at auctions, animals and meat at slaughter slabs, and buildings and hygiene conditions at butcheries, bars and restaurants), food vendors, business owners (of butcheries, bars and restaurants) and their employees (such as cooks and waiters), license inspectors (business and TFDA licenses) and health workers who provide mandatory health checks for workers in butcheries and restaurants and bars.</p> <p>The meat chain generates considerable revenues in the form of market fees, movement permits (outside of districts), fees for the use of slaughter slabs, fees for business and TFDA licenses, income taxes, as well as in the form of rentals and utility fees.</p> <p>Prices of cattle and meat vary seasonally in relation to supply and demand, being lower in the dry season due to high supply (many farmers selling livestock to raise money for crop requirements) and low demand (limited “free” money and ready availability of cheaper alternatives in the form of fish and green vegetables), and higher in the dry season due to lower supply (many producers can sell crops instead of livestock) and higher demand (more money circulating and fewer alternatives).</p>
d. Management and integration of pastoralism	
Literature review of the lessons learned regarding the integration of pastoralism in agriculture landscapes in Tanzania, East Africa and beyond as relevant, pointing out	<p>Pastoralists are often minorities living in geographically remote areas away from centres of economic and political activity and, thus are often marginalized socially, politically and economically.</p> <p>Pastoralists typically live in remote areas which suffer from poor levels of services such as education, health and water supply.</p> <p>Pastoralists suffer from a general negative perception whereby they are viewed as being backward and resistant to progress, tribalistic, non-nationalistic, rebellious and illiterate.</p> <p>Pastoralists suffer from inadequate representation in decision making</p>

Issues	Main Findings
concrete policy and planning options	<p>structures and processes from local to national levels.</p> <p>Pastoralists lack the necessary knowledge and skills for protecting and demanding their rights.</p> <p>Policy makers, driven by misperceptions of pastoralism and their disapproval of a way of life that is not their own, have persisted in developing inappropriate policies and interventions, particularly in areas of governance, management of land and natural resources and economic development.</p> <p>Pastoralists have become increasingly vulnerable due to population growth and climate change, the effects of which are greatly exacerbated by unfavourable policy and legal environments.</p> <p>Demographic trends are very much linked with other trends in pastoral areas, especially as regards loss of rangeland and commercialization of livestock production and marketing.</p> <p>Pastoralists often suffer from a lack of land ownership and insecure tenure.</p> <p>In some areas pastoralists have suffered from policies that have constrained their mobility hence diminishing access to rangeland resources.</p> <p>There is a clear linkage between pastoralism and enhanced agricultural production, through use of animals for traction, use of manure to enhance soil fertility, and use of livestock in provision of financial services.</p> <p>Agropastoralists, such as the Sukuma, often provide an important link in terms of general understanding and acceptance between sedentary farming communities and mobile pastoral communities.</p> <p>In areas of relatively high rainfall, where crop production is a viable option, pastoralists are coming under increasing pressure from farmers and, in the absence of tenure, often lose their land and way of life.</p> <p>Sedenterization of pastoralists, as is happening in the Kilombero Valley, typically results in ecological changes, economic changes, and changes in dietary intake and health and social life.</p> <p>Women and children are particularly vulnerable to impacts of sedentarization, which despite better access to education and health services, often results in poor nutrition, inadequate housing, lack of clean drinking water, and higher rates of infectious diseases.</p> <p>Official statistics tend to overlook many important benefits of pastoral livestock production leading to under appreciation of the contribution of pastoralism to local, national and regional economies, hence the need to adopt a more robust TEV approach.</p>
Potential policy and planning options	<p>Improve understanding and perceptions of pastoralists</p> <p>Develop capacity of pastoralists to participate in debates</p> <p>Support pastoralists to improve representation in decision making bodies at local and national levels</p> <p>Support investment in rural infrastructure, including roads, access to clean water and education and health services</p> <p>Investigate and address the particular needs of women and children in pastoral societies</p> <p>Support pastoralists in venturing into crop production</p>

Issues	Main Findings
	Develop local conflict resolution systems
Efficacy and equity of measures put in place by GoT / LGAs especially since 2012 to manage the livestock and pastoralism sector within the KVRs	<p>Although grazing and watering of livestock within the KGCA is restricted, pastoralists continue to utilize resources within the KGCA, particularly during the dry season, and are commonly fined for doing so.</p> <p>Previous efforts to remove pastoralists from the KGCA in 2012/2013 were implemented with unacceptably high costs to pastoral communities, do not appear to have been successful and should not be repeated.</p> <p>Whilst many pastoralists suffered strong detrimental impacts under this programme, it appears that cattle populations within the KGCA have rapidly re-established.</p> <p>In future, such exercises are likely to be subject to much higher levels of scrutiny and accountability; and it is likely that any evicted families will need to be provided with fair compensation and access to alternative lands. The costs of such measure are likely to be prohibitive.</p> <p>Existing district livestock plans provide for standard livestock development interventions aimed at modernizing the livestock sector in line with the national livestock policy. Implementation has been minimal due to budget constraints.</p> <p>Other than some advocacy work following the previous evictions, there has been virtually no other NGO support to the livestock sector in the Kilombero Valley.</p>

4.2 FUTURE MANAGEMENT AND INTEGRATION OF PASTORALISM

Cattle make an essential contribution to the local economy of the Kilombero Valley, sustaining large numbers of pastoral families (including a high number of dependents) and employees; enhancing crop production through use for ploughing and transport, application of manure and provision of finance; and, through the selling of cattle and distribution of meat, supports further livelihoods of butchers and restaurants traders and associated workers, and in the form of payments of fees and taxes makes a strong contribution to government revenues.

Future management of the livestock sector should reflect this understanding and seek to maximize the potential benefits of livestock. The question then becomes how best to fit livestock in with other complementary and competing sectors, and how to manage the livestock sector within a framework of environmental, social and economic sustainability? How do we achieve a pathway whereby future livestock production is sustainable and contributes to poverty reduction?

In the absence of any interventions cattle numbers will continue to grow, primarily through natural growth. There is a clear trend of additional resident families starting to keep cattle, primarily as a means to enhance crop production through improved access to tillage services as well as use of manure and transport. This can be expected to continue, so leading to increasing numbers of producers and sustained pressure for increased numbers of livestock.

However, the present system is already under stress, particularly as regards access to grazing resources and to a lesser extent water sources. Many large pastoralists are pessimistic about the future, predicting a decline in their livestock numbers due to continuing human population growth and associated demand for land for settlement and farming and thus continued losses of grazing lands. Already there are high levels of conflict between farmers and livestock producers, primarily due to cattle entering fields and causing damage to crops, and with KGCA authorities due to

pastoralists grazing and watering their animals within the KGCA. Future levels of conflict with farmers and KGCA authorities can only be expected to increase.

Previous management efforts have focused on the exclusion and removal of pastoralists and cattle from the KGCA. These have been implemented at great cost to pastoral communities, and yet do not appear to have been sustainable, in that there appears to have been a rapid re-establishment of cattle populations including within the KGCA. Such exercises, in future, are likely to be subject to much higher levels of scrutiny and accountability, and will likely require that evicted families are provided with adequate compensation and access to alternative lands, so making them more difficult and costly to implement.

Further efforts to exclude all livestock from the KGCA are likely to also become increasingly costly to local governments, will lead to greatly elevated levels of conflict, including within village areas, and will contribute to enhanced poverty of pastoralists, and reduced livelihoods of participants in the downstream meat chain from traders to consumers. A more productive route would appear to be to seek to work together with livestock producers rather than to remain locked in confrontation, and to seek to accommodate livestock within the KGCA rather than to exclude them.

Formalizing grazing by livestock within the KGCA would entail environmental risks associated with the growth of cattle populations and which would need to be managed. Pastoralists and cattle are already implicated in the displacement and elimination of large wildlife from much of the Kilombero Valley. High numbers and stocking rates of cattle can be expected to result in detrimental impacts to the environment, including loss of biodiversity, pollution and destruction of water resources, and compaction and erosion of soils. These risks are enhanced in that livestock populations within the Kilombero Valley are relatively sedentary rather than mobile. It will thus be necessary to develop mechanisms for limiting numbers of livestock within the KGCA. This is likely to entail improved marking of animals and the implementation of paid access rather than the present system of free access to grazing resources. It will require a better understanding as to how many cattle the system can sustainably support, and it will be necessary to develop systems for collection, allocation and sound management of revenues, taking into account the need to guard against local corruption. It will also require development of supporting infrastructure such as water sources, dip tanks and markets, primarily within village areas, as well as innovative extension approaches.

Given that the KGCA is surrounded by village land, and that much of the KGCA area is seasonally flooded, it will clearly be necessary to work closely with and achieve a high level of cooperation from adjacent village governments towards sound management of livestock production and grazing resources. In working closely with livestock producers and village authorities, this may have the additional benefit of restraining further expansion of farms into the KGCA, which represents a greater threat to biodiversity and future provision of downstream water supplies than livestock production.

An alternative and complementary approach could be to take a broader perspective and look for alternative grazing areas elsewhere. The initial stimulus for pastoralists to come to the Kilombero Valley was largely due to push factors elsewhere in the country, including population growth, loss of access to/displacement from traditional grazing areas and possibly climate change. A complementary approach to accommodating pastoralists within the Kilombero Valley and KGCA could be to identify alternative grazing areas elsewhere in the country to where pastoralists could be relocated. Such areas would need to be supported by policy and legislation that would allow for the identification and protection of designated grazing areas, and provide a framework for their management and development for livestock keeping. However, this is a broader issue that was considered to lie outside the scope of the present project.

4.3 WAY FORWARD

A feedback workshop to present and discuss the results of the diagnostic studies on land, livestock and fisheries was held on 31 January 2017 in Morogoro. This was attended by members of central government, local government, academics and NGO staff, as well as project staff and the consultant team.

For the pastoral sector the main issues arising concerned:

Quantification of the overall economic value of the livestock sector

Further elucidation of present plans and management of grazing resources within village areas.

Concerns regarding potential adverse impacts from livestock grazing within the KGCA

Concerns regarding the costs of managing a mixed wildlife and cattle system

Quantification of the overall economic value of the livestock sector is hampered by the absence of sound data on current numbers of livestock producers and particularly livestock, as well as incomplete data on the local red meat value chain. Data from district offices suggests a total of 13,482 cattle owners and 236,763 cattle for the three districts of Ifakara, Malinyi and Ulanga (this includes additional villages outside of the KGCA and Kilombero Valley).

According to district estimates cattle require one hectare grazing each. Using the above figure, this suggests there is a need for 236,763 ha of grazing for the three districts. Yet in Kilombero only seven out of 24 villages assessed had designated grazing areas, with a total area of 3,254 ha; and for Ulanga District the comparative figures were 20 villages with set grazing areas with a total area of 17,013 ha. Although these figures are incomplete they demonstrate an extreme mismatch between current designated grazing areas and cattle populations. At the time of drawing up land use plans, despite the presence of pastoralists and livestock, most villages chose not to set aside grazing areas and for those villages that did, the areas were very small.

Grazing by large herbivores can result in detrimental environmental impacts to vegetation, soils, water resources and biodiversity, as is recognized by livestock owners. In general, the scale of impacts will be proportional to the stocking rate. Historically, the Kilombero Valley has supported large wildlife populations but which have now been eliminated and replaced by cattle. Clearly, the area can support large herbivores, and if populations can be controlled it will be possible to restrict the scale of impacts to acceptable levels.

Drawing on experience elsewhere in the country, additional concerns were raised about the potentially high costs of managing mixed cattle and wildlife systems, including direct costs of veterinary support for livestock as well as for providing food assistance to communities in times of need. Neither of these factors are directly applicable to the Kilombero Valley, firstly, because wildlife has already been virtually eliminated such that there is minimal scope for mixing of wildlife and livestock and, secondly, unlike other areas, enabling grazing of livestock within the KGCA would not entail any settlement (potential cattle producers are already settled and registered in neighbouring villages), such that this would not imply any direct responsibility by the KGCA towards the welfare of users of the grazing resources.

Based on the study findings and subsequent workshop discussions, it is recommended that:

- In order to support improved management of grazing resources within both villages and the GCA additional data needs to be collected on the size of the present livestock herd, on rangeland potential and on the spatial pattern of water points.
- For village land, a trial area covering a number of adjacent villages should be selected with a view to examining the potential for rationalizing land use plans in order to establish fixed and coordinated grazing areas. This should be done in coordination with and support of the corridor component of the land diagnostic.
- For the KGCA, given that continued prohibition of all grazing by livestock is likely to prove expensive, and time consuming to implement, to be a source of on-going and escalating conflict and, ultimately, will probably be unsuccessful; it is proposed to investigate the potential for developing a system of controlled grazing within the GCA and to implement this in a limited experimental area on a trial basis.
- Carry out additional advocacy work to strengthen the supporting environment for livestock production within the Kilombero Valley, specifically through publication of existing socio-economic data; through further elucidation of the meat value chain; and through targeted training for village and district government staff.